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FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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A, A. Wheels, 30 in. diameter
B. Main Backbone Tube.
C. Upper Strut Tube.
D. Central or Seat Tube.
E. Tubes from Rear Hub to Bottom Bracket.
F. Tubes from Rear Hub to Seat Tube.
G. Steering Post.
J. Steering Barrel.
K. Handle Bar T-Piece.
L. Handle Bar.
M. Brake Work.
N. Lamp Bracket.
O. Seat L-Pin.
P. Saddle and Spring.
Q. Mud-Guards.
R. Mud-Guard Stays.
S. Bottom Bracket.
T. Foot-Rests.

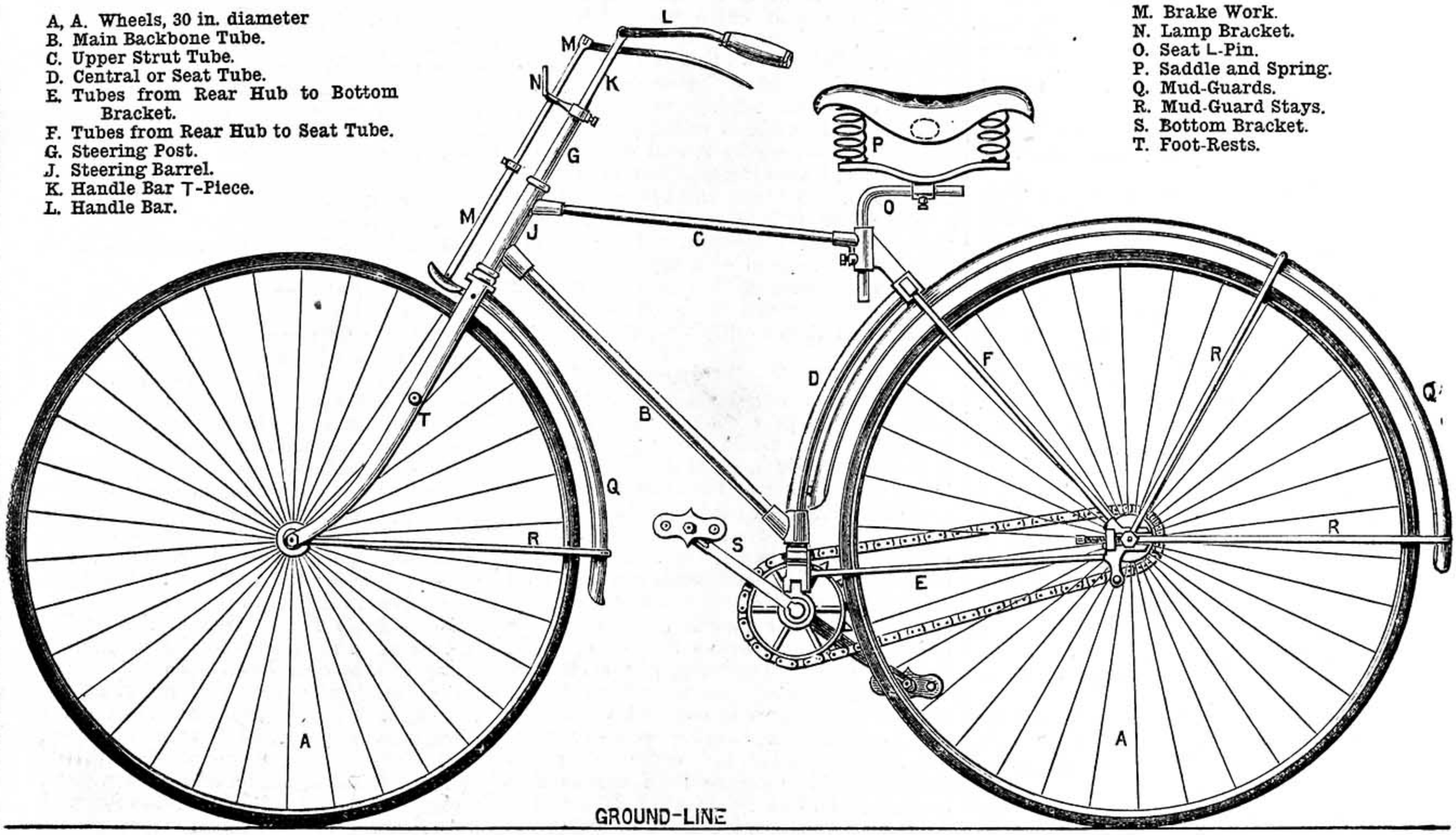


Fig. 1.—Diamond Frame Safety Bicycle. (One-tenth full size.)

THE SAFETY BICYCLE: ITS PRACTICAL CONSTRUCTION, ETC.

BY A. S. P.

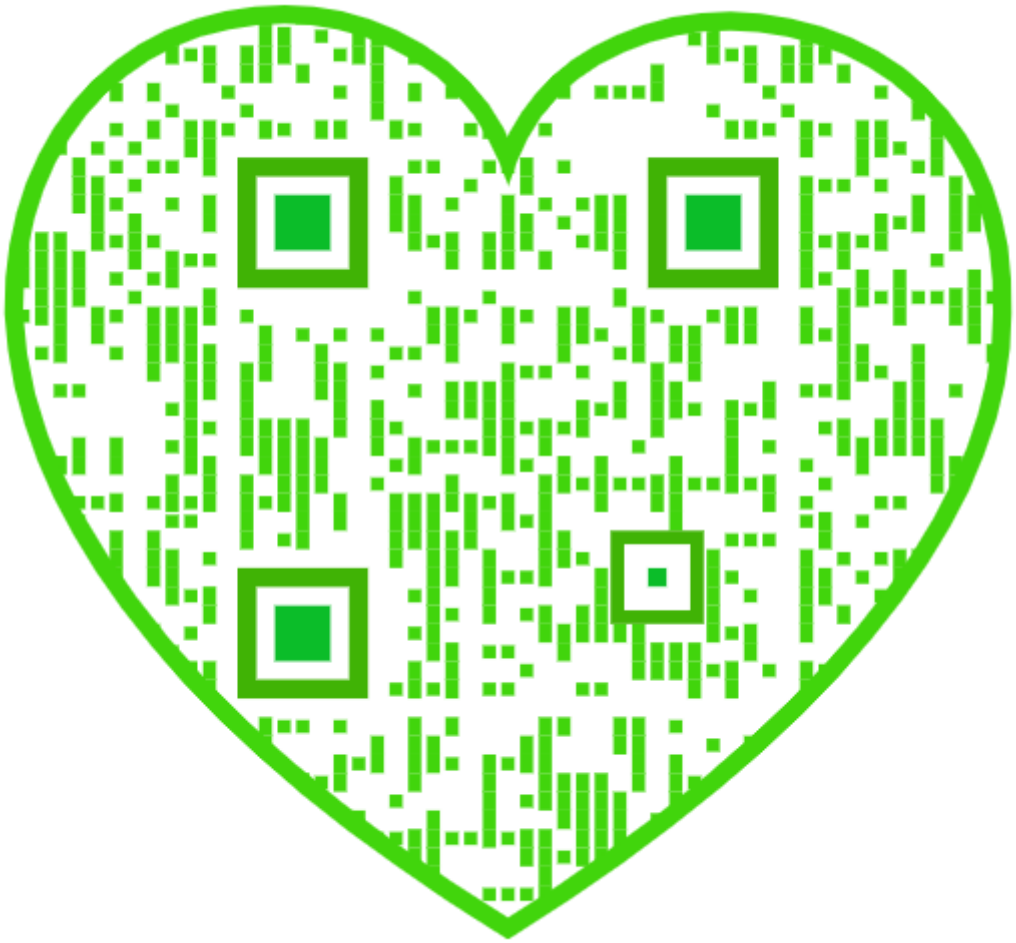
INTRODUCTION—DESIGN AND PARTS—MATERIALS—WHEEL HUBS—SPOKES, ETC.—SOLID PARTS—PARTS THAT MAY BE PURCHASED—SPEED—RULE FOR GEAR-UP—NECESSARY TOOLS—LATHE—FORGE—ANVIL—VICES—GRINDSTONE—SCREWING TACKLE—RATCHET BRACE—SMALLER TOOLS—HOME-MADE TOOLS—LATHE CHUCKS, GAUGES, ETC.

Introduction.—It is proposed in a series of papers to describe the practical construction of the pedo-motive machine now well known as the "Safety Bicycle."

It may be inquired in the outset, Whence the name safety bicycle? for there is no bicycle—or tricycle either, for that matter—absolutely safe. The bicycle so called is only safe by comparison with that known as the "ordinary," and in that comparison it is certainly very much safer; but an absolute safety bicycle is not yet in existence, nor is it ever likely to appear. However, the name has become conventional, and we must stick to it in describing what we call the "Diamond Frame Safety Bicycle."

It is a curious fact that the original bicycle, with its wooden wheels and iron tyres, bore a striking resemblance to the modern safety: it had nearly equal wheels, from 30 in. to 36 in., connected by a backbone and fork similar to the modern cross frame; it was driven with cranks on the front wheel, and was not geared up; whereas the modern safety is usually driven by cranks and chain from the rear wheel, and may be geared up to any extent.

Design and Parts.—I propose describing a machine of my own design and make, and while the frame bears a general resemblance to many, it is different from any known to me. A reference to the accompanying drawing of the complete machine will show this, and that the frame exactly as it is shown is "not to be found in any of the books." There are several details which I claim as good things, and which will be described in due course. The drawing of the machine here shown—which I may say, for convenience of illustration, is one-tenth full size, or on a scale of $1\frac{1}{5}$ in., or 1·2 in. to 1 ft.—will be frequently referred to in future papers. The reader, therefore, who essays to construct his bicycle from the instructions given in this series would do well to keep the part of WORK containing the drawing at hand, or make an enlarged drawing from it, or, better still, a full-size working drawing on a board about 4 ft. 6 in. by 3 ft. 6 in., and lettered or figured for reference. In the drawing Fig. 1 the various parts of the diamond frame safety are as follows:—A, A, two wheels: in this case 30 in. diameter; B, main backbone tube; C, upper strut tube; D, central or seat tube; E, two tubes, one on either side, from rear hub to bottom bracket; F, two tubes, one on either side from rear hub, joining seat tube D at junction of upper tube C; G, steering post joined to the crown of the front fork H; J, steering barrel, either fitted plain on to the steering post G or having balls at both ends—in this machine it will be shown in detail fitted with cone surfaces; to this barrel are attached the two tubes B and C; K, handle bar T-piece, made to adjust by sliding freely in the steering tube G; L, handle bar, with horn handles; M, brake work, consisting of lever under handle bar, spoon immediately over the wheel tyre, and connecting tube and rod; N, lamp bracket; O, seat L-pin; P,



saddle and spring; Q, mud-guards; R, mud-guard stays; S, bottom bracket, which carries the driving shaft, chain wheel, and cranks; to this bracket is attached the tube B, and also the two tubes E; T, foot-rests, one on either side of the front fork.

Materials.—Having named the *principal* parts of our machine—for it will hardly be credited that in a machine of this sort there are over 320 parts, counting the chain as one part—we may now turn our attention to the materials of which these parts are composed.

Wheel Hubs.—The wheel hubs are gun-metal, having steel caps fitted in the ends where the balls run. The pins, or axles passing through these hubs, are steel, and are fitted with hollow cones. These cones and the caps, together with the balls, are all made very hard, so as to stand wear.

Spokes, etc.—The spokes are of best steel wire, specially made for this purpose. The wheel rims are crescent steel or hollow steel, as the case may be. Rubbers best red or grey.

Solid Parts.—The solid parts, such as bottom bracket S, steering barrel J, and C, are steel stampings or malleable castings. The L-pin O is a bit of round steel bar $\frac{5}{8}$ in. thick. All the tubes are weldless steel, 18 Birmingham wire gauge. The mud-guards are made from light sheet steel rolled to size of wheels, and hollow in section. The mud-guard stays are light rods, either round or flat, as may be preferred. The front fork is hollow weldless steel tapered and curved at lower ends, and joined to a crown piece at their upper ends.

Parts that may be purchased. — The following parts are usually purchased ready made from makers or dealers:—Hubs, to be bought bored, tapped for spokes, and plated; cranks and pedals, finished and plated; chain in lengths; saddle and spring, or both in combination; horn handles; rubbers for tyres, pedals, and foot-rests. Then the accessories are lamp, tool-bag, spanners, oil-can, etc.

It may be mentioned that hubs can be bought in the rough, and fitted up by the mechanic himself; and the same with bottom brackets, pedals, cranks, etc.

Speed.—It is a puzzle to many non-mechanical minds how the safety bicycle, with its small wheels, usually 30 inches, can be so speedy as the large-wheeled ordinary, for it is a fact that many people cannot be made to understand how the chain in combination with two different size wheels has the property of gearing up the small wheel to equal its big brother of the ordinary. Of course, anyone with but a small modicum of mechanical brain can see it. It is also a fact that thousands of riders of the safety can tell you what their own machine is geared up to, because the agent or maker told them, but they cannot by rule of arithmetic demonstrate for themselves the gear-up of their machine. The rule is a very simple one, as will be seen presently, and I insert it here for the benefit of those to whom it may be useful.

Rule for Gear-up.—The rule is to multiply diameter of driving wheel by number of teeth on chain wheel (that is, the wheel that is mounted on the bottom bracket shaft), and divide result by number of teeth on chain wheel of rear hub. Say the driving wheel is 30 in.; teeth on large chain wheel, 18. Multiply 30 by 18—result, 540. Divide 540 by 9—answer, 60. Nine is the usual number of teeth on the hub chain wheel, and in the following three examples 9 is used as the divisor:—

(1) Driving wheel .. .. 30 in.
Large chain wheel .. .. .. 18 teeth
Hub chain wheel ... . 9 ,,

Then $\overline{30 \times 18} \div 9 = 540 \div 9 = 60$ in.

The machine is geared up to 60 in., or double that of the 30 in. wheel.

(2) Driving wheel .. .. 30 in.
Large chain wheel .. .. .. 16 teeth
Hub chain wheel .. .. .. 9 ,,

Then $\overline{30 \times 16} \div 9 = 480 \div 9 = 53\frac{1}{3}$ in.

In this case the machine is geared up to $53\frac{1}{3}$ in.

(3) Driving wheel .. .. 30 in.
Large chain wheel .. .. .. 14 teeth
Hub chain wheel .. .. .. 9 ,,

Then $\overline{30 \times 14} \div 9 = 420 \div 9 = 46\frac{2}{3}$ in.

In this case the machine is geared up to $46\frac{2}{3}$ in.

If you continue reducing the number of teeth in the lower or forward chain wheel, keeping the hub chain wheel the same—namely, 9—you are gradually lowering the gear. Bring down the number of teeth till both wheels have the same number, 9, and of course the machine is not geared up at all, and is what is called geared level. Multiplying a sum by 9, and dividing the result by 9, leaves the sum just as it was—thus, 30 in. $\times$ 9 = 270, and 270 $\div$ 9 = 30.

The above rule is easily carried in the memory or in a note-book, and anyone can easily tell the speed of a machine by taking the diameter of the driving or rear wheel, counting the teeth on both chain wheels, and then multiplying and dividing as above.

Necessary Tools.—Before commencing the construction of our bicycle, some mention must be made of the tools required. The proper place to conduct such a piece of work is the mechanic's shop, whether the regular business mechanic or the amateur, as these papers are intended for both. It cannot be expected that the trained mechanic—say, a machinist—who has never made a bicycle or looked into its mechanism can know all about it without a little instruction, any more than the amateur mechanic who may have confined his efforts to the making of model engines, electric machines, and such like. The working mechanic may have to his hand most of the tools required for bicycle construction, and, having possibly more practice in their use, may make better progress with his machine than the average amateur. Unless he is what is called a gentleman amateur, his stock of tools is, as a rule, very limited, and many of them only a makeshift for the purposes they are put to. So for the benefit of the amateur with limited means I will name the tools he cannot well do without, unless he means to bother outsiders to do this and that operation for him. The indispensable tools are:—

Lathe.—A turning lathe, back speed, with slide rest. The back speed is for turning iron, and the quick speed for brass and wood turning. The slow speed is also used for heavy drilling, and quick speed for small drilling.

Forge.—A small forge for brazing and light forgings, sharpening, and tempering drills, etc.

Anvil.—A small anvil fixed to a bench; or, better still, a small-sized smith's anvil on a block.

Vices.—A large strong leg vice attached to a substantial vice board, bolted through the wall for firmness. A good parallel bench vice, 3 in. or $3\frac{1}{2}$ in. jaws; also one or two hand vices, different sizes.

Grindstone.—A grindstone, not less than 14 or 15 in., in a metal trough, is a most useful tool for setting up turning tools, drills, etc.

Screwing Tackle.—As to this, I use two die stocks, one having pairs of dies $\frac{3}{4}$ in. fine thread, $\frac{3}{4}$ in. and $\frac{5}{8}$ in. Whitworth thread; the other having dies, Whitworth standard, $\frac{1}{2}$ in., descending by $\frac{1}{16}$ in. to $\frac{1}{4}$ in.; and these I find serve nearly every purpose in the trade. For nipple screwing I use a small die stock, with five pairs of dies from $\frac{1}{8}$ in., rising by $\frac{1}{32}$ in. to $\frac{1}{4}$ in. Then for spokes I use the ordinary small size five-hole screw plate, and the one-hole plate supplied by makers and dealers, usually with two taps, for each size of spoke. Common spokes, not butted, have heads on them when bought, and consequently no spoke heading machine is needed; but butted spokes have the butt larger than the holes in the rim, consequently they must be passed through the rim from the inside before a head is riveted on. For this purpose a heading machine is used: it is a ponderous affair, costing four or five pounds, and buying it, except for makers and repairers, is out of the question. I have not one of these, but use as a substitute (a makeshift, if you like) an instrument that does the work fairly well. It consists of two steel plates which clamp the spoke, and, being held firmly in the vice, the head is hammered into shape. I will give an illustration of this instrument in its proper place.

Ratchet Brace. — A ratchet brace, for boring out broken spoke stumps and for many other purposes, is necessary. I use one of these with a small three-jaw cheek that holds drills from 0 in. to $\frac{3}{16}$ in. I invariably use twist drills for this tool. I use also twist drills, from $\frac{3}{4}$ in. downwards, for the various borings in the lathe.

Smaller Tools.—As to these, they are such as are to be found in any mechanic's kit—callipers, pliers, wire-cutting nippers, centre and other punches, an assortment of files, wrenches, spoke grips, nipple keys, and numerous other little things that suggest themselves to the tidy workman.

Home-Made Tools.—One of the qualifications of a mechanic is the making of many of his own tools. In this many clever mechanics are nothing short of inventors. I have several machines I never should have possessed but in this way. One of these is a small vertical driven by foot. It has a bracket and division plate, for drilling hubs from four holes to forty. I have another machine which screws spokes with three turns of a small wheel, and does the work more rapidly and more accurately than anything I know of. Another machine of my own construction is used for grinding and polishing with emery-wheels; another for bending tubes. I may have occasion in the course of these papers to describe at length some of these machines.

Lathe Chucks, Gauges, etc.—Of course, much work may be done without these machines: thus, hubs may be drilled in the lathe; spokes may be screwed by simply gripping them in the vice, and fixing the screw plate to the end of the ratchet brace, filing up and polishing by hand without the grinding machine. Every mechanic, however, who can possibly afford it should provide himself with a couple of chucks for his lathe—one a four independent jaw chuck, and the other a two-jaw chuck, to hold small pieces of work, such as pins, and to hold the twist drills from 0 in. up to $\frac{3}{4}$ in. or so. Either of the chucks referred to can be bought for about 55s. About the most useful article I have is the Birmingham wire gauge plate. For sizing wire, drills, pins, and other purposes, it saves a large amount of time. Stubbs' letter gauge is also used for sizing twist drills, etc., but being costly, its use may be dispensed with.

ELECTRO-GILDING BROOCHES, CHAINS, RINGS, ETC.

BY GEORGE EDWINSON BONNEY.

INTRODUCTION — TOOLS REQUIRED — BATTERIES: DANIELL'S BATTERY, WOLLASTON'S BATTERY, SMEE'S BATTERY, GASSNER DRY BATTERY— THE VATS — THE GILDING SOLUTION — INFERIOR GILDING SOLUTION.

Introduction.—Jewellers in a small way of business in country towns and other out-of-the-way places, have little trinkets handed to them to be repaired and electro-gilt or electro-plated. As it is not always convenient to send these little jobs to London or to Birmingham, there may be some who will be glad to know how they may be done at home in their own workshops. There may also be a few amateur metal workers who may be glad to know how to gild or silver a few little trinkets and other knick-knacks for their lady friends and relatives. To meet the possible wants and wishes of such readers as these, I have written a short series of articles, showing how such little jobs may be done at home with a few tools, many of which can be made by the working jeweller or the amateur metal worker.

Tools required.—In the catalogue issued by Messrs. Canning and Co., Great Hampton Street, Birmingham, the following list is given, under the head of "Watchmakers' and Jewellers' Gilding and Silver-Plating Outfit":—Two 6 in. Daniell batteries in box, 1 lb. sulphate copper, 1 pint sulphuric acid, 1 pint gold solution, 1 porcelain gilding vessel, 1 Bunsen burner, 1 pint rich silver solution, 1 porcelain vessel, 1 pint copper solution, 1 duplicate vessel, 3 stands for holding vessels, 8 oz. cyanide potassium. The whole, packed in box, with book of instructions, for £6.

This will give some idea of the tools required; but this is not all. In addition to the articles above mentioned, there will have to be such things as brushes to clean the goods before being plated, and polish them afterwards; wires to suspend the goods in the plating solution, various cleaning solutions, and vessels to hold these; and last, but not least, a plate of each of the metals mentioned, to form an anode in each of the solutions. Therefore, although I give the above list as a sample of those submitted to the intending plater, I beg leave to prepare one myself, and give a detailed account of each article required.

Battery.—As we shall electro-deposit a coat of silver on a piece of metal from a solution of silver, we must have a generator of electricity—that is, something in which the electricity can be made as wanted for the work. The cheapest and most simple method of doing this, for the purpose now under consideration, is to make up an electric battery, or a voltaic generator of electricity. There are quite a host of different electric batteries in the market, but there are only a few suitable to this work. Daniell's battery is mentioned in the above list. This is made up of a stoneware pot in which stands a cylinder or a plate of copper, and a pot of porous earthenware inside this, containing either a bolt or a plate of zinc. The outer containing pot is charged with a saturated solution of copper sulphate, and some crystals of this are suspended in the pot to keep the solution in a saturated condition. The porous pot is charged with water made acid with sulphuric acid, in the proportion of one part acid to fifteen parts of water. The zinc must be kept coated with mercury, and must not touch the sides or bottom of the porous pot. The porous pots or cells, 6 in. in height, will cost about 4d. each. The outer jars may be salt-jars, or even wide-mouthed pickle bottles. Any sheet copper, however thin, will do for the cylinder. The zinc may be also in the form of a cylindrical roll of sheet zinc, but this should be at least $\frac{1}{8}$ in. in thickness. The Daniell battery is very constant. Whilst the sulphate of copper solution is kept saturated and the zinc kept in working order, the current will not flag at all during the day; it is therefore most suitable for silver-plating and gilding, but it is very troublesome to keep in working order, unless kept well at work and employed every day. As a jeweller or an amateur may not have daily jobs to do, a troublesome battery is an inconvenience, for time can badly be spared in cleaning up the parts and getting them in working order whenever a little job comes in.

The Wollaston battery is the least costly and least troublesome, but it is also most inconstant, as its current is apt to rapidly fall off after being set to work. However, as it recovers its strength after a few minutes' rest, it is a handy battery for such short jobs as generally fall to the lot of the country jeweller. It may be made at home as follows:—Get some three or four open-mouthed jars of glass, stoneware, or porcelain, of any size from one quart to one gallon, the larger size being preferable. These jars will serve as battery cells, no porous pots being required. Next get some three or four plates of rolled zinc, just large enough and long enough to go in the selected jars. Clean the plates well in hot water containing some washing soda, then rinse them in clean water. Pour some water in an earthenware baking-dish, about enough to cover a zinc plate; then pour in carefully about one-tenth quantity of oil of vitriol. In this mixture immerse the zinc plates, one at a time, and pour on each a small quantity of quicksilver. Spread the quicksilver over both sides of each plate with a mop made of tow containing a few brass wires, and then coat them perfectly. This is termed "amalgamating the zincs." The acid mixture may be used with some more to work the battery, and the excess quicksilver can be used over again.

These zinc plates will be suspended to a cross-head of wood (each plate between two plates of copper in each cell); so we must now prepare the wood supports. These should be cut out of hard wood to the shape shown at Fig. 1, so as to enclose each zinc plate between two pieces of wood, the plates fitting in the recesses cut for them. The wood should now be well varnished, or, better still, well soaked in melted paraffin wax. Each zinc plate can then be enclosed between two wooden supports, these secured to each other by long brass screws passing through both, and the plate held up by a binding screw on the top, as shown at Fig. 2.

We must now get a pair of copper plates to each zinc plate, and these should be of the same size as the zincs, or they may be a little larger than the zinc plates with advantage. They may be of any thickness. If they can be cross-scored with a file, or have a rough coat of electrotype copper deposited on them, they will work all the better for the treatment. It will be better still if they can be coated with platinum, but this will necessitate the use of a battery and a platinum solution, which is costly. The copper plates may be secured to the cross-heads on each side of the zincs by very short brass screws, care being taken not to let any of them touch the zinc plates; or they may be clamped with brass clamps sold for the purpose, as shown at Fig. 3. This method of connecting the battery plates has the advantage over others of portability, since it is always quite easy to unclamp the plates to clean them, and reverse the zinc plates so as to wear both ends equally.

The battery jars are charged with an acid mixture, made by pouring one part by volume of sulphuric acid (oil of vitriol) into twelve parts of water, and allowing it to cool before using. The plates are suspended by the wooden cross-heads in this mixture. When it is wished to increase the pushing force of the current, the copper plates of one cell are connected by a length of No. 16 copper wire to the zinc plate of the next cell, and so on through the whole series of cells, taking in as many as may be wanted. When a low-tension current of large volume is desired, all the copper plates of the cells are connected together by one set of wires, and all the zinc plates by another set of wires. The cells may be placed in a wooden tray or in a shallow box, and all the cross-heads may be secured to a long bar of wood, which may be suspended to a support above, or to an arrangement for lifting all the plates out of the cells when the battery is not wanted. This arrangement will also be found to be most convenient for controlling the current, as its volume can be lessened at any time by exposing a less surface of the plates to the action of the battery acid. When the battery is not required for use, the plates should be lifted out of the cells, and if they are not likely to be wanted for a few days, they should be well rinsed in an abundance of water, to free them from acid. It will be necessary to take out the zinc plates occasionally, clean them, and freshly amalgamate their surfaces. This must be done at any time if the plates give off a hissing noise, and appear to be blackened by the acid.

The Smee battery is employed by small electro-platers and gilders. This battery is made up in a similar manner to that just mentioned. Platinised silver foil, soldered to copper frames, is used instead of copper plates for the negative elements, but in all other respects the battery may be made like the Wollaston just described, and will give similar results, with this exception—its action is longer sustained after being connected to the work, because it does not so soon polarise.

When a jeweller wants a battery to just do a few gilding jobs or to merely flash on a thin coat of silver to hide defects or discoloured patches, and is only likely to use the battery for a few minutes at a time during the day, I strongly recommend the Gassner dry battery. This battery needs no attention in the way of setting up or cleaning, as it is always ready for work, and will furnish current sufficient to gild a brooch, scarf pin, or even a bracelet, or to silver-plate such an article with a thin coat of silver. The large double-carbon square cells should be selected for this purpose, and the battery should be made up of two of these cells in series. They cost about 4s. 6d. each cell, and will last about two years, without renewal, on such intermittent work as I have just described. If used for big jobs, taking more than ten minutes in the doing, the battery will soon be exhausted. If the Gassner battery is selected, it will not be necessary to provide a sulphuric acid solution, since no solution of any kind will be required to work this battery.

The Vats.—These are the vessels to hold the depositing solutions of gold, of silver, or of copper. Gilding solutions are worked

hot, at a temperature varying between 140° and 180° Fahr.; we must therefore provide a vat that will bear being heated up to this point. "Well," the tyro might say, "why not use an iron or a tin vessel, such as a saucepan?" Because the gilding solution will eat away iron or tin, and become spoiled with these metals, and because the gold will be deposited on the sides of the vat, and thus cause a loss of this precious metal. But the homely saucepan is not to be despised, for it is a useful article, and may be easily pressed into service. If we put the gold solution into a stoneware or porcelain jar, and place this in a saucepan, together with some hot water, we may heat the solution in the saucepan by placing it over a gas stove or over a fire, or any other source of heat. If the saucepan is lined with porcelain, or vitrified, or enamelled, we may heat the solution in the saucepan without using a porcelain or a stoneware jar, and the saucepan will then serve the purpose of a vat.

The silver solution will be worked cold, so we shall not require a vessel to stand the heat as a vat for this solution; but it must not be of metal, because the cyanide of potassium in a silver solution will dissolve a metal vat, and the silver is liable to be deposited on its sides. It does not act quickly on lead; and this is sometimes used to line vats employed to hold plating solutions, but a lead-lined wooden vat would be too cumbersome for our purpose. If only a quart or two of silver solution is employed, we may find a stoneware vessel large enough to hold the solution. A large stoneware battery jar will serve the purpose very well, but either the stoneware or the glass troughs used for the cells of accumulators will make the best of vats for silvering solutions. If these cannot be easily obtained, and a bell glass can be got—that is, a glass vessel shaped like a bell, and employed by gardeners to cover their plants, and by fish fanciers as aquariums for gold fish—this can be easily improvised as a plating vat. Carve out a wooden pedestal to hold the knob of the glass, and cement this into the wood base. Do not use a common earthenware vessel, whether glazed inside and out or not, as these are snares, ever liable to be destroyed by the cyanide and to break when least expected.

The coppering solution I shall recommend can be worked cold or hot, and may therefore be held in a vat similar to that employed for the silver solution. The vats may be stood on any bench or on a shelf. They will not need any other stand, but, for the sake of cleanliness, it is advisable to place each in a lead-lined tray, to catch any accidental drops of the solution, as this will penetrate wood and leave a disagreeable odour about the shop, even after all the plating things have been put away.

The Gilding Solution.—After several years' experience, I find the following the cheapest and best for the amateur gilder and the jeweller in a small way of business. Get one pint of distilled water from a druggist's shop, and also half a pound of best 95 per cent. cyanide of potassium. Please understand that this latter-named article is a deadly poison, and will injure health if handled with the naked hand. There will, therefore, be some difficulty in getting it, and when got, great care must be exercised in using it, and in keeping it in a safe place when not in use. It should be kept in a wide-mouthed glass-stoppered bottle, under lock and key. Dissolve two ounces of the potassium cyanide in one pint of hot distilled water, and place it in the vessel intended to serve for a vat. Get two strips or plates of pure gold, weighing from 7 to 10 dwts. each; punch a small hole in the upper edge of each, and hang each strip on a hook made of No. 20 platinum wire. Hang one strip in the vat connected to the wire leading from one pole of the battery (say, the zinc plate), and the other strip of gold to the wire leading from the other pole of the battery. See that the gold only

Fig. 1.—One-half of Wood Support for Battery Plates.

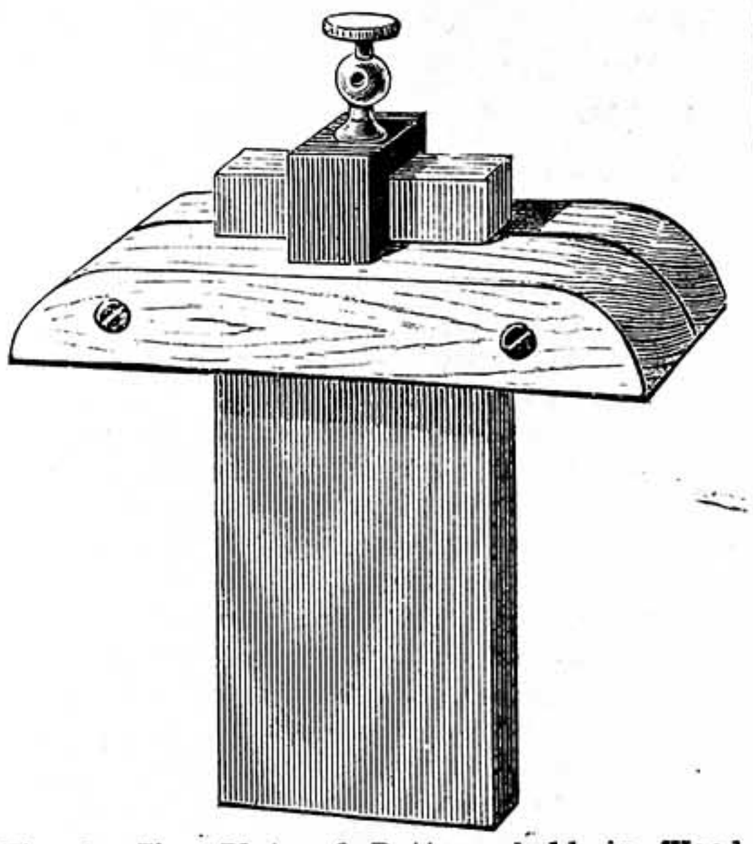


Fig. 2.—Zinc Plate of Battery held in Wood Support.

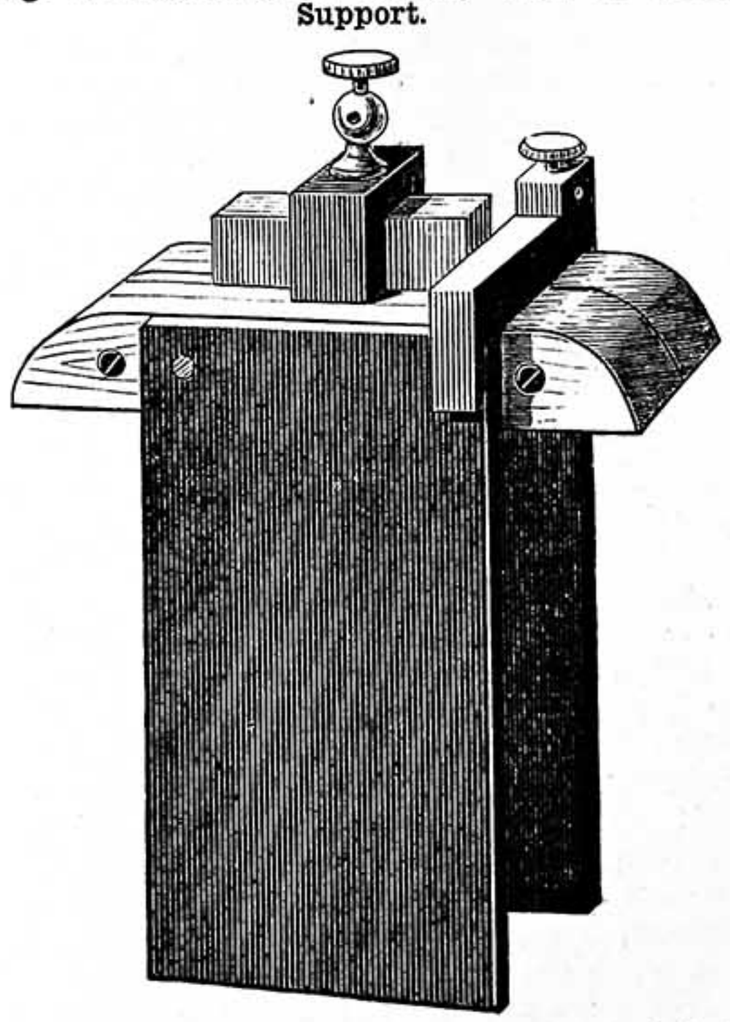


Fig. 3.—Battery Plates mounted on Wood Support and clamped together, ready for use in Cell.

dips deep enough in the cyanide solution to just touch the platinum hooks, but do not allow the copper wires to hang in the solution. Copper and gold will dissolve in cyanide solutions, but platinum will not dissolve in them. We want to dissolve the gold, and so make up a gilding solution, but we do not want any copper in the solution, as this will make the gold of a dark colour. If all has been done right, an electric current will pass from the zinc plates in the battery to the copper plates, and from these along the wire to the gold strip in the cyanide solution, through this, and back to the battery by way of the other gold strip and the wire leading to the zinc plate, thus completing the electrical circuit. Whilst current is passing in this way, gold will be dissolved off from the strip of gold hanging to the wire leading from the copper of the battery, and will be taken up by the cyanide of potassium to form the double cyanide of gold and potassium solution. Keep the solution heated up to 160° Fahr., and keep the battery connected to it for one or two hours. At the end of this time hang a German silver wire for a moment or two in the vat, connected to the wire leading from the zinc of the battery. If the wire takes on a coat of a satisfactory character, hang both strips of gold to the opposite wire, and call them gold anodes, and connect the work to be gilded to the cathode wire—that is, the wire from the zinc of the battery. The action of the battery may be carried on until 5 dwts. of gold have been dissolved into the solution, or we may commence gilding with only 1 dwt. of gold to the pint of solution. The quantity of gold in the solution can always be augmented if the surface of the things to be gilded is less than the surface of the anodes, and there is an excess of cyanide in the solution. The contrary condition will result, of course, in an impoverishment of the solution. A solution rich in gold deposits a rich-looking coat of gold in a short time, whilst one poor in gold works slowly, and deposits a poor-looking coat.

A full battery of at least three Wollaston, Smee, or Daniell cells, or two Bunsen cells, should be used in making the gilding solution, but it can be worked afterwards with a battery of one cell. The Gassner or the Leclanché are both unsuitable to use in making up the solution, but may be used in working it after it has been made up.

An inferior gilding solution may be made up by stirring into the cyanide solution enough chloride of gold to turn the solution green, then adding enough cyanide to take away the green tint. This will deposit a coat of gold of a fairly good colour, but the gold coat is apt to strip off whilst being polished or burnished. The best depositing solution is that of the double cyanide of gold and potassium made up by the chemical method, but the process for doing this requires more than an amateur's skill, and results in a great loss of gold when attempted by unskilled persons.

In another paper I hope to show how to prepare the articles for gilding, to work the gilding solution, and finish the goods after they have been gilded.

AN EASILY-MADE RECEPTACLE FOR PARTS OR NUMBERS OF "WORK."

BY A. BEAN.

"ALAS! things are not as they seem." This trite quotation has been so often used to express disappointment and disgust at expensive purchases which had been regarded as valuable in an equal degree, until suddenly discovered to be just the reverse, that it is quite a pleasure to be able to employ it (without its dispiriting prefix) in connection with a perfectly honest article.

As such we may fairly consider, I think, the book about to be described, and which is shown in the annexed illustration. This sketch, as the reader will no doubt observe, portrays apparently a neatly bound copy of

WORK; but the uninitiated searcher who may peer under its cover in natural expectation of help, in place of receiving any useful assistance from this volume, will find that the so-called book has resolved itself into a mere box; which, however, in its very singularity, may, let us hope, compensate somewhat for the absence of the anticipated assistance.

To its would-be maker, at any rate, this book-box will offer many inducements apart from that of novelty. For one thing, it is decidedly most useful for a variety of purposes. It is, moreover, easier by far to construct than the binding of a volume of printed sheets; which may, indeed, be so spoiled either by the sewing or the cutting of the edges as to be beyond the power of anyone, professional or amateur, to repair. Indeed, the greatest incentive of all, to one who has ever endeavoured to satisfactorily smooth the edges of books by the ordinary methods of the amateur, will be, I think, the fact that here, at all events, he will be spared that trial.

To those readers who do not possess the bookbinder's usually most used appliance, it will doubtless be an additional relief to learn that for our present purpose a press is quite unnecessary; the only tools required being a knife (known to dealers in cutlery as a French one), a folding stick or thick bone paper-knife, a glue-pot, and a brush.

Any ordinary binding material may be used in covering this box, but I should recommend, as being the most suitable, the leather denominated roan (which may be had of any colour) as protection for the back and the corners, bookbinder's cloth of a similar shade being placed on the sides. For lining the interior of the box, paper of a drab or grey shade is to be preferred, whilst the seeming edges should be covered with marble paper.

The boards needed will be one No. 3, and two No. 6 black ones, the former measuring 18 in. by 16 in., and the latter 12½ in. by 9¼ in. each. About a quarter of a yard only of cloth will be necessary, whilst the piece of leather should measure 20½ in. by 6 in. You will need no more than a sheet each of the lining and marbled papers.

Having obtained these essentials from any bookbinder, you may cover the thinner millboard on one side with the drab paper and cut it to the shape shown in Fig. 2. It should then be scored or cut half through its thickness with a sharp knife along the dotted lines on the uncovered side.

This will enable you to bend up the outstanding portions without cracking the board, after which, in order to secure them in place, you should glue strips of cloth along each angle on the outside of the box. About ¼ in. of each of these four pieces should be turned in over the upper edges, whilst their lower ends to the extent of half an inch should be attached to the foundation. One side of the board you will of course have arranged to fit the curve of the two end-pieces, so that a properly shaped back may be formed. The finishing touch to this portion of the volume is given by affixing a strip, 32 in. by 3½ in., of marble paper around the three straight sides.

I may here perhaps be allowed to mention a difficulty with which you will doubtless have noticed I have to contend in describing this book as a box, and *vice versâ*. For you must not forget that the *sides* of the box form the edges of the book, whilst the two sides of the latter are spoken of as top and bottom respectively in the case of the former.

However, we may now leave the box proper for the present, and turn to the consideration of its surroundings. For these you must cut the piece of leather as shown by the lines in Fig. 3, the portion A being required for the back, and the offcuts B for the corners; the remaining small square may be regarded as useless save for the purposes of experiment.

Now make your knife as sharp as possible, and employ it in cutting or paring down the edges of the five pieces of roan, using a slab of glass or porcelain to support the leather against the pressure of the blade. The four similar portions should then be

Fig. 1.—Book-Box as Receptacle for Parts or Numbers of "Work."

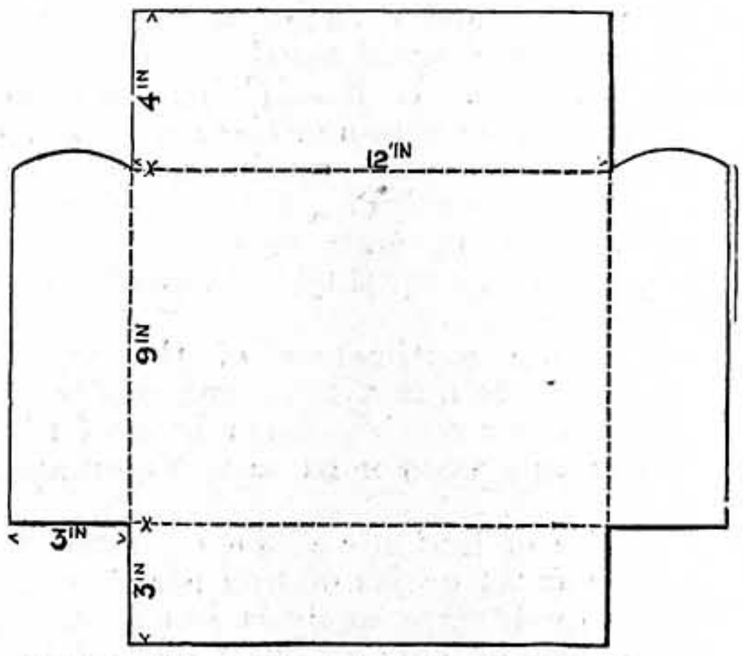


Fig. 2.—Plan of Pasteboard for Body of Box.

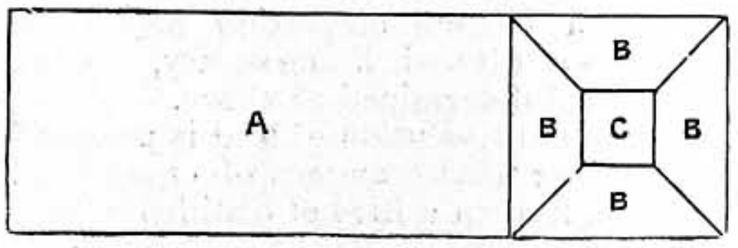


Fig. 3.—Mode of cutting Leather for Back and Corners of Case.

parted and placed on two corners of each board, their oblique edges being turned over their borders. After pasting the larger piece thoroughly over, lay at a distance of 1½ in. from each of the longer edges the uncornered margin of one of the boards. A short piece of thick cord should then be placed across each end of the leather, reaching from corner to corner of the boards, in order to strengthen the roan somewhat; the overhanging portions being then turned tightly over in the same style as the smaller pieces.

Two pieces of cloth, each 14 in. by 9 in., should now be cut, and after just so much of their corners has been removed as will allow their leather substitutes to fully appear, affixed to the boards with thin glue, their extreme edges being turned in as before.

The inner and outer divisions of the volume will now be quite ready for amalgamation. This must be done by attaching the rounded *side* of the box to the leather back of the case with rather thick glue. After well rubbing these two together with the folding stick, you may then fasten the bottom of the box to the corresponding side of the cover.

To give finish to the upper portion of the receptacle, a strip of cloth 1 in. wide and 12 in. long should now be neatly glued along the inner joint of the board—or lid if you choose—where fastened to the curved side of the box, a piece of marble paper 12 in. by 8¾ in. being then evenly applied to the inside of that upper cover.

A box, however it may be enclosed, is scarcely a fit subject on which a 'prentice hand may successfully practice gold lettering; therefore, if you have not already had some experience in that branch, I should advise you to either employ the painter's method, or give instructions to the binder for its embellishment.

If the former plan is adopted, the back must first be divided into seven portions or panels, the five inner ones being made quite equal whilst the upper one should be about ¼ in. longer, and the lowermost one only half that length. A line of, say, $\frac{1}{16}$ in. should then be drawn between each of these divisions with a fine brush charged with gold size, additional ones being also placed parallel to the head and tail of the back, and also against the verge of the sides of cloth.

These lines must be left until they are very nearly dry, when you may lay over them the gold leaf or bronze powder in the same manner you have no doubt often observed painters adopt when using these materials.

If you succeed in doing this portion satisfactorily, you may then write the word WORK or other title with the same liquid on the second panel of the back, afterwards attaching the gold as before.

This plan, although perhaps somewhat of an innovation, will nevertheless give the book quite a legitimate appearance; and will look as well, if not better than many far more elaborate attempts with the ordinary tools of a book-finisher.

PROMISCUOUS EXERCISES IN CHEMICAL ANALYSIS.

BY "CHEMICUS."

As examples, let us take "The detection and estimation of lead in potable waters," "The analysis of solder," "The determination of *added* water in milk," "The analysis of white lead," and "The estimation of moisture, ash, and sulphur in coal."

DETECTION AND ESTIMATION OF LEAD IN POTABLE WATERS.

The presence of lead in potable waters may be readily detected by adding two cubic centimetres of a saturated, freshly prepared solution of sulphuretted hydrogen to fifty cubic centimetres of the water, acidified with ten drops of acetic acid, contained in a Nessler's cylinder. Should the water hold solid matter in suspension, or be turbid, it is filtered previous to applying the test. This applies also to the bichromate method of detection described hereunder. If the metal be present the

water upon standing some little time will acquire a brown colour, varying in depth of tint in proportion to the amount contained in the sample. For comparison, fifty cubic centimetres of lead free water, contained in a Nessler's cylinder, are treated in a precisely similar manner. Should the fifty cubic centimetres yield negative results, half a litre of the water is taken, the volume reduced by evaporation to fifty cubic centimetres, filtered if necessary, cooled, and the above test applied. If this portion also gives negative results, the water is free from lead.

It is claimed by the author, Mr. Sidney Harvey, that the presence of one-fiftieth of a grain of lead per gallon may be readily detected by the method described hereafter. And further, that no other metal likely to be contained in the water gives the same reaction with the reagent employed—viz., bichromate of potash. The principle of the method is, that lead salts form with bichromate of potash insoluble precipitates of chromate of lead.

In applying the test, 0·13 grammes of powdered bichromate of potash is added to half a litre of the water contained in a glass conical, the liquid well stirred and allowed to stand at rest, alongside, for comparison, of a similar conical containing half a litre of lead free water, to which the same quantity of bichromate of potash has been added. During the course of fifteen to twenty minutes a decided turbidity will be formed, should lead be present, while at the expiration of about twenty-four hours a precipitate will have settled at the bottom of the containing vessel, so that the supernatant liquid can be drained off almost to the last drop.

Lead being a very serious contamination of potable waters, since, when taken into the system, it accumulates and does not pass through, we give the following simple method for its detection, so that those of our readers who do not possess a knowledge of chemistry—and undoubtedly they are many—may determine for themselves whether this injurious and poisonous metal be present or not in their water supply. For the carrying out of the process, the apparatus required consists of an ordinary glass tumbler, and two bright and perfectly clean knitting needles; while the only chemical employed is acetic acid, or, if this is not at hand or procurable, vinegar. The *modus operandi* of the method is as follows: Fill the tumbler at least three parts full with the water to be examined, and add a dozen drops of acetic acid, or a teaspoonful of vinegar. Should the water be turbid, treble these quantities are added. Thoroughly mix the contents of the tumbler by carefully stirring with the needles, immerse the needles in the water, and allow them thus to remain in contact with the water, with occasional stirring, for some considerable time. From time to time withdraw one of the needles, always the same one, and examine its surface for dark or brown spots; or if the amount of lead is considerable, a grey coating, varying in depth of colour in proportion to the quantity present, which will be formed should lead be contained in the water. If, after immersion in the water for some eight to ten hours, the needles remain free from any spots or coating, even when examined with the aid of a magnifying glass, as will be the case when only small quantities of lead are present, withdraw the needles and allow to dry, precautions being taken to exclude dust, for twenty-four hours. If at the end of this time the needles have acquired no yellow, or reddish-yellow colour, the water is free from lead.

For the *quantitative determination* of the lead, fifty cubic centimetres of the water are carefully measured out into a Nessler's cylinder, four drops of acetic acid, together with two cubic centimetres of a saturated, freshly prepared solution of sulphuretted hydrogen, added, and the whole mixed. The colour of this solution is now compared with that of fifty cubic centimetres of pure distilled water, contained in a Nessler's cylinder, to which four drops of acetic acid, and two cubic centimetres of the sulphuretted hydrogen, as also one cubic centimetre of a standard solution of lead containing in every cubic centimetre ·0001 grammes of lead, have been added. To compare the colours of the two solutions, place the containing vessels side by side on a sheet of white unglazed paper, or a porcelain slab, and look down through them.

Should the colours of the two liquids differ, various quantities, larger or smaller as required, of the standard lead solution are added to fresh portions of fifty cubic centimetres of pure water, acetic acid and sulphuretted hydrogen added as before, until the quantity of the standard lead solution necessary to produce equality of tints in the two solutions is arrived at. Since each cubic centimetre of the standard lead solution contains ·0001 gramme of lead, the quantity of lead, in grammes, contained in fifty cubic centimetres of the water under examination will equal the number of cubic centimetres of the standard solution required to produce equality of tints multiplied by ·0001, and therefore a litre (1,000 cubic centimetres) will equal this quantity multiplied by 20. By multiplying grammes per litre by 70 we obtain *grains per gallon*.

Example:—50 cubic centimetres of the water taken for analysis. Number of cubic centimetres of standard lead solution required to produce equality of tints=6 cubic centimetres.

∴ 50 cubic centimetres of the water contains ·0001 × 6 = ·0006 grammes of lead.

∴ 1,000 cubic centimetres (a litre) of the water contains ·0006 × 20 = ·012 grammes of lead.

∴ *Grains* of lead *per gallon* of water = ·012 × 70 = ·84 *grains* of lead per gallon.

If the qualitative analysis has revealed the presence of only a small quantity of lead, a litre of the water is evaporated down to a volume measuring fifty cubic centimetres, filtered if necessary, cooled, and the lead determined as above.

The standard solution of lead is prepared by dissolving ·1831 grammes of crystallised acetate of lead in a litre of distilled water.

SOLDER.

For the analysis the sample is cut up into small pieces, the smaller the better.

Weigh out into a conical one gramme of the solder, add fifty cubic centimetres of a mixture of equal parts strong nitric acid and water, and heat gently. When solution is effected, add 250 cubic centimetres of dilute nitric acid—one acid to six water—and carefully evaporate the solution down until it becomes pasty. When cool add 250 cubic centimetres of the dilute nitric acid, boil until the volume is considerably reduced, dilute the liquid with water, and allow to stand until the resulting metastannic acid has completely subsided to the bottom of the containing vessel. Collect the precipitate on a double Swedish filter, and wash until free from acid. Dry the filter paper with contents, remove the dry precipitate as completely as possible to a tared crucible, ignite the filter paper separately, add the ash to contents of crucible, ignite the whole at a strong red heat, and when cool re-weigh to determine the oxide of tin, SnO_2, which contains 78·67 per cent. of metallic tin.

Concentrate the filtrate remaining from the determination of the tin if the volume occupied is at all considerable, cool, add pure sulphuric acid in slight excess, and then twice the volume occupied by the solution of methylated spirits. Allow the solution to stand for some considerable time, collect the resulting precipitate of lead sulphate, $PbSO_4$, on a filter, wash with water acidulated with sulphuric acid, and subsequently with methylated spirits. Dry filter paper with contents, remove the dry precipitate to a tared crucible, and ignite the filter paper in the manner described in the article on "Brass: Its Analysis" (Vol. II., page [367). Add the filter paper, ash, etc., to the contents of the crucible, ignite the whole, and weigh the $PbSO_4$, which contains 68·32 per cent. of lead.

DETERMINATION OF THE "ADDED" WATER IN MILK.

To arrive at the extent to which milk has been adulterated by the addition of water, it is necessary to make a determination of the "Solids not Fats," which is conducted as follows:—Carefully tare a perfectly clean platinum dish and in it place about ten cubic centimetres of the milk. Re-weigh the dish to determine the exact weight of the milk taken, and then submit to the action of the water-oven until evaporation to complete dryness has taken place. This beng effected, the dish and contents are allowed to cool, the dry residue covered with 100 cubic centimetres of benzoline, and heated in the water-oven until one-half of the benzoline has evaporated off, when the dish is withdrawn, allowed to stand until the solid particles have completely settled to the bottom, and the liquid then carefully decanted off. Repeat this treatment with benzoline some half dozen times, and after the final treatment, decant off as completely as possible the liquid, dry the residue in the water-oven for an hour, allow to cool, and weigh. Replace in the oven, heat for a further period of half an hour, and again weigh. If the second weight does not agree with the first, the dish and contents are again subjected to the action of the water-oven until a constant weight is obtained. The residue thus obtained is the *solids not fats* contained in the weight of the sample operated upon; it is calculated on 100 parts by weight. In genuine milk the percentage of *solids not fats* is 9 per cent., and should it be under, the sample may be considered as watered.

The percentage of *added water* in milk is the difference between amount of pure milk in which percentage amount of *solids not fats* found are contained, and 100.

To determine the amount of *pure milk* in which the amount of *solids not fats found* is contained, it is assumed that 9 *parts of solids not fats* are contained in every 100 *parts* of *genuine milk*. Example:—

A sample of milk upon analysis is found to contain 8·00 per cent. of *solids not fats*. If, therefore, 9 per cent. of *solids not fats* are contained in 100 *parts of genuine milk*, 8 *per cent. of solids not fats* are contained in 8—100 ÷ 9 = 88·88 *parts of genuine milk*.

The amount of *added water* is, therefore, 100—88·88=11·12 per cent.

White Lead.

The chief adulterations of the white lead of commerce are barium sulphate, calcium carbonate (chalk), and oxide of zinc. Barium sulphate, however, cannot be considered an adulteration unless it be present in quantities exceeding 5 per cent., since it serves to protect the lead from the blackening action of sulphuretted hydrogen.

The following is the method of analysis:—Weigh out one gramme of the sample, spread in a thin layer over the bottom of a small porcelain dish, and burn off the oil at a low temperature, continuing the ignition until no black carbonaceous matter remains. Cover the residue while hot with dilute nitric acid, digest at a gentle heat, dilute the solution and filter. Wash the insoluble residue on the filter free from acid, dry, ignite and weigh.

The residue thus obtained should be qualitatively tested for barium sulphate in the following manner:—Place a small portion of the residue on the end of a platinum wire, moisten with hydrochloric acid, and hold in the flame of the blowpipe, when if barium be present the flame will acquire a green colour. If no coloration be produced, the residue consists of silicates. It is not usual to separate the barium sulphate and silicates should both be present.

The filtrate remaining from the above determination is evaporated to near dryness to expel the excess of acid, diluted, heated to near boiling, and a current of sulphuretted hydrogen conducted through to saturation. (The solution must be distinctly acid, otherwise zinc sulphide will be precipitated.) The liquid is then allowed to stand at rest for some time, and the resulting precipitate of sulphide of lead collected on a filter and washed with sulphuretted hydrogen water. The filter paper with contents is then placed in a tared porcelain crucible, covered with strong nitric acid, gently heated until the acid is driven off, when the temperature is increased to redness, and the crucible, after cooling, re-weighed to determine the lead sulphate, $PbSO_4$. Every 100 parts of lead sulphate is equivalent to 88·118 parts of lead carbonate, $PbCO_3$.

To the filtrate from the sulphide of lead, add ammonia and ammonium sulphide in excess, close the mouth of the containing vessel, and allow to stand at rest in a warm place for some hours. Collect the resulting precipitate of sulphide of zinc on a Swedish filter, wash, dissolve in hot dilute hydrochloric acid, dilute the resulting solution, heat to boiling, and re-precipitate the zinc in the same, as carbonate, by the addition of sodium carbonate in excess. Heat to boiling, filter off the carbonate of zinc, $ZnCO_3$, wash thoroughly with hot water, ignite in a porcelain crucible, and weigh the resulting oxide of zinc, ZnO.

The ammonium sulphide filtrate remaining from the above determination, after the addition of hydrochloric acid, is evaporated to dryness, the residue brought into solution by digestion with dilute hydrochloric acid and filtered if necessary. The solution is then made strongly ammoniacal, ammonium oxalate—prepared by dissolving one part of the crystals in ten of water—added and heated to boiling for some time. The resulting precipitate of calcium oxalate collected on a Swedish filter, washed with water, converted into lime, CaO, by ignition at a strong heat, and weighed as such. Every 100 parts of CaO is equivalent to 242·857 of $CaSO_4$.

As regards the arrangements of the results, the residue insoluble in nitric acid is returned as *barium sulphate and silicates;* the lead as *lead carbonate;* the zinc as *zinc oxide;* and the lime as *calcium sulphate.*

The Determination of Moisture, Ash, and Sulphur in Coal.

Moisture. — Carefully weigh out five grammes of the coal, which has been reduced to a fine powder, spread in a thin layer over the bottom of an iron dish or the surface of a clock glass, and submit to the action of the water-oven for an hour. At the expiration of this period, re-weigh the coal to determine the loss in weight which it has suffered, which loss represents the *moisture* on the quantity taken for analysis.

The portion thus deprived of moisture is preserved in a well-stoppered bottle, from which the various portions required for determination of ash and sulphur are taken.

Ash.—Weigh out into a large, shallow, tared platinum, or porcelain dish, one gramme of the moisture freed sample and gently ignite, with a free excess of air, over a Bunsen burner until the volatile matter is expelled and the coal is thoroughly coked. When this is effected, increase the heat to bright redness, and maintain at this temperature until the residual ash is free from black carbonaceous matter. This being attained, allow to cool, and re-weigh the crucible to determine the ash.

To ascertain whether combustion is complete, ignite the crucible with contents for a further period of ten minutes, allow to cool and re-weigh. The second weight should agree, within experimental error, with the first; if it does not the ignition is repeated until a constant weight is obtained.

Sulphur.—Intimately mix one gramme of the dry powdered coal with twice its weight of pure calcium oxide (lime), place the mixture in a platinum crucible and gently ignite over a *spirit lamp*, or, as is preferable, in the muffle, for half an hour. When this period has expired, increase the heat to bright redness and maintain at this temperature for about an hour, upon the expiration of which time remove the crucible from the source of heat and allow to cool. Cover the contents of the crucible with a small quantity of a saturated solution of ammonium nitrate, and apply a gentle heat until the liquid is driven off. By thus treating with ammonium nitrate, the calcium sulphide, formed by the combination of the sulphur of the coal with the calcium of the lime, is oxidised into calcium sulphate. Oxidation having been effected, place the crucible, when cool, in a beaker, cover with pure hydrochloric acid, and digest at a gentle heat until the mass has dissolved out. Withdraw the crucible after washing, dilute the solution, filter through a Swedish filter paper and wash. Dilute the filtrate, which now contains as sulphuric acid the whole of the sulphur present in the coal, to 250 cubic centimetres (the solution must be distinctly acid, but free from a large excess), add ten cubic centimetres of barium chloride solution, and allow to stand in a moderately warm place for twelve hours. Decant off as much as possible of the clear supernatant liquid, collect the resulting precipitate of barium sulphate on a Swedish filter, wash twice with dilute hydrochloric acid and thoroughly with water, ignite and weigh. Barium sulphate, $BaSO_4$, contains 13·37 per cent. of sulphur.

It is advisable to form a blank experiment with the re-agents employed, taking the actual quantities of each as employed in the analysis of the coal.

DESIGN FOR GLOVE BOX IN FRETWORK.

BY ROBERT COXON.

Subject of Design: "Music."

This design, if executed in a good hard wood, vulcanite, or brass, either as fretwork on another ground or in inlay, would make a very artistic article, either for gloves for a lady or any other articles for which it might be used.

The drawings are worked out full size, the top (Fig. 1) and end view (Fig. 2) complete, the side view (Fig. 3) repeating from centre, *c c.* The accompanying small sketch

Fig. 4.—Sketch of Glove Box complete.

(Fig. 4) will serve to show the work complete, and could be either hinged or as a lid at the option of the workman. Figs. 1, 2, 3 will be found in page 41.

Having designed it to suit brass inlay work, for which it is more suited in the delicate portions, the workman must slightly thicken those parts if intended for wood execution.

It would also make a good subject for a music stand, either for a piano front, table stand, or upright, the top piece forming centre, with the side view repeated top and bottom, and mounted on coloured satin, silk, or velvet.

For the box, also, coloured material might be used as lining, or, if preferred, gilt cardboard mount or thin sheet brass would make a more suitable background to a dark wood like ebony or vulcanite, the inside being mounted in plush or velvet.

FURNITURE AND ITS GLASS.

BY DAVID DENNING.

Glass as a Decorative Feature—Plate Glass — Silvering — Preparation of Frame — Measurement of Glass and Bevels—Purchasing Glass.

After wood, there is no material which forms such an important part in cabinet furniture as glass. Of course, the appearance is referred to more than the actual construction when it is said that glass is so important a feature; for glue, nails, and other odds and ends are, so far as joinery is concerned, of infinitely greater use than glass. They, however, are not supposed to be visible, and in good work are not more so than is absolutely unavoidable. Glass, on the contrary, is introduced into furniture almost entirely owing to the decorative effect which it gives when judiciously used. There are, of course, those who object to the use of glass in furniture except to the smallest extent, and from their point of view the reasons they give for doing so are not trivial. It is, however, not so much my intention to discuss the use of glass from an artistic basis as to offer a few hints of a practical kind to those who will have glass in their rooms. As one who has paid some attention to the subject, perhaps I may be allowed to make a few remarks about the general employment of glass. So far as I can understand the objections to its use, they are mainly because glass is seldom found in old furniture, and then only in

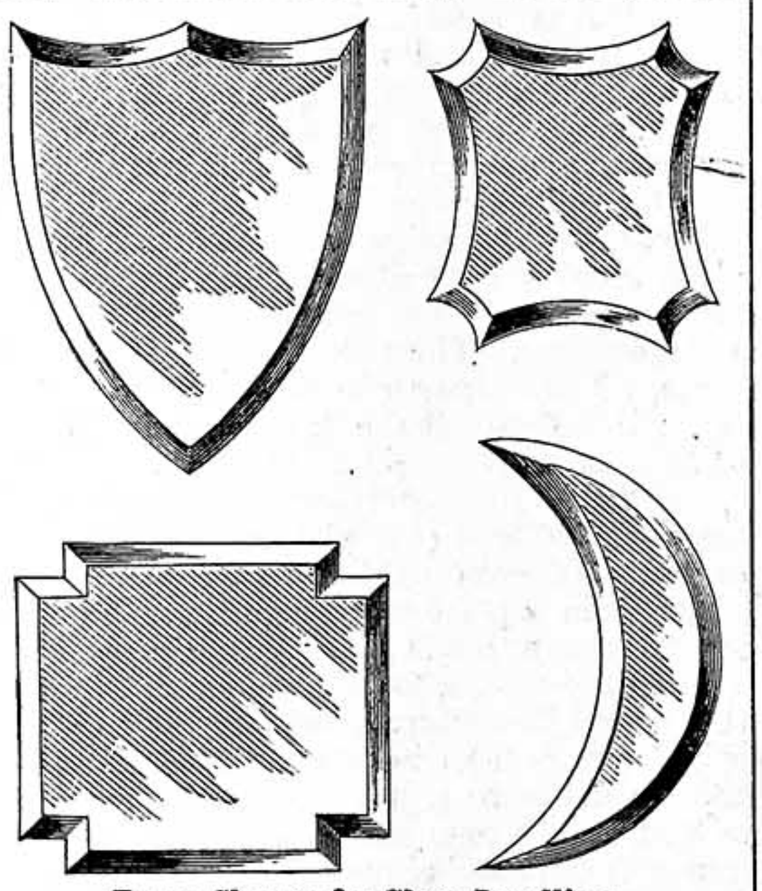
small pieces. It was never employed in large sheets; therefore, to do so now is an evidence of want of good taste, as the glitter is apt to destroy the repose which should characterise the interior of our dwellings. That is what has been said by the "utterly too too" artistic section of the community. Now, let us just look at the subject from a popular or common-sense point of view.

It is quite true that till a comparatively recent period glass was not used in large pieces in furniture, but its absence is not to be taken in any way as a proof of its use having been purposely avoided. Probably the real reason is to be found in the fact that glass has not always been obtainable in large sheets or plates. What is not made cannot be used, so that large mirrors never being found in old furniture merely shows that the old cabinet-makers had not got it to use. It is nothing but nonsense to urge that their superior artistic instinct induced them to use glass in great moderation, and only in small pieces. Whether or not glass is ornamental in furniture is to a great extent a matter of personal opinion on which everyone has the right to decide for himself—unless, indeed, he has a better half, for then he may possibly find his rights restricted. Those who do not like glass may have wood or some other material instead, while those who wish for plenty of it can have their wishes gratified to almost any extent without being thought peculiar or addicted to vulgar decoration. At the same time, it must not be understood that I am advising the excessive use of glass, for, personally, I am decidedly of opinion that it should be employed judiciously and in moderation—or, rather, I should say, with discretion.

The advantages of glass as a decorative material in furniture construction are so manifest that it may seem almost unnecessary to say anything about them. It must suffice just to remind decorators that they have a most useful material to deal with, and that they can combine utility with ornament. After all, if everything that might be said both for and against glass as a decorative part of furniture were to be urged, it merely resolves itself into this—glass is fashionable and popular. We find it largely used in overmantels, sideboards, cabinets, and all kinds of fancy furniture, principally in a silvered state—*i.e.*, as looking-glass or mirror. In furniture, transparent glass is comparatively little used, and when it is its object is principally to allow of the contents of the cupboard, or whatever it may be, to be seen. An ordinary bookcase with glazed doors will occur to most people as a familiar example.

Undoubtedly, a great stimulus to the use of glass as a purely decorative detail of furniture has been given by the greatly decreased cost of bevelling the edges. As is well known, the bevelled edges to all mirrors greatly improve their appearance, and when the small extra cost is taken into account it seems hardly worth while to economise by having plain edges. As so many amateurs wish to do everything for themselves—and doubtless it is a creditable wish—this may be an opportune place to say that neither glass bevelling nor glass silvering are suitable occupations for them. On a small scale they cannot be practised successfully. It will be found much more economical to get the glass ready silvered and bevelled from a dealer. With proper plant and appliances, both bevelling and silvering can be done at a very reasonable figure. I mention these matters, as several inquirers have desired to be informed in the "Shop" columns how they can do silvering. When they know, any efforts they may make are almost sure to end in disappointment. Of course, I do not wish to discourage any, but it is better for them to know that the "game is not worth the candle" in the opinion of those who are best able to judge.

No doubt most readers are aware that the kind of glass ordinarily used for mirror purposes is known as "plate." It is more suitable than the commoner and cheaper sheet glass, from the fact of its having a more even surface, and other good qualifications. It is also fairly thick, so that the edges can be suitably bevelled. Another kind of glass, the thin or "patent plate," is only used when the ordinary kind is too thick for the purpose. For bookcase doors and transparent panels both plate and sheet glass are used. For ordinary furniture the latter is quite suitable, and is much cheaper than the former, which is, however, preferable when first-class quality is necessary. The silvering is now generally done by what is known as the "patent process," to distinguish it from the older one, in which mercury and tinfoil were used. In the patent



Fancy Shapes for Glass Bevelling.

process pure silver is chemically deposited on the glass.

Having said enough about the actual material, it will be well after this preliminary chat to say something about the work of fitting and fixing the glass into the furniture—taking up the subject, in fact, from a practical or workshop point of view, so far as it concerns the cabinet-maker. Of course, it goes without saying that the more he knows about the material the better for himself, but this knowledge is not so necessary to him as an acquaintance with the ordinary workshop methods of actually using the glass, and combining it with wood in constructing furniture.

It may seem almost unnecessary to say that the edges of glass used in furniture are laid within a rabbet, but a few remarks about the rabbet itself are not uncalled for. Perhaps the chief point that the maker of any frame which it is intended to fit glass to should attend to is the absolute necessity of having it "out of winding." If it is "in winding," it stands to reason that a perfectly flat, even sheet of glass cannot be close to the wood which should support it. The consequence is, that as a space between the wood and the surface is unsightly, the workman may be tempted to try and force the glass into its proper position—*i.e.*, so far as appearance is concerned—for the proper position is naturally that in which the glass lies close, without any coaxing or straining. It may, when speaking of glass, seem strange to those who are not accustomed to working it to refer to its being forced to lie against a frame in which it does not bed naturally.

Glass is usually regarded as so absolutely rigid that any attempt to cause it to bend would be useless. Now, although for ordinary purposes glass may be considered inflexible, it is not perfectly unyielding, but any curve that may be imparted to it in order to get it to lie close against an imperfect frame is got at the risk of fracture, not only at the time, but even afterwards, especially if it is moved. It will easily be understood that the larger the glass the more readily it can be forced to fit a faulty frame; but the fact that the larger the glass the greater will be the cost of replacing it in the event of a fracture should not be overlooked. It will be found better not to try and adapt glass to a frame, but to make the frame as it should be for the reception of the glass.

From what has been said, it does not require great perceptive faculties to understand that the flat, or portion of the rabbet on which the glass lies, must be on the same level all round. In other words, the rabbet on each of the sides of the framing must be cut to exactly the same depth. To make the matter perfectly clear, let us suppose that on three sides of a rectangular frame the rabbet has been cut to a depth of $\frac{3}{4}$ in., while on the remaining one it is $\frac{1}{4}$ in. deeper. It is evident that a piece of glass of proper size being let into the frame will lie on the wood of the sides first mentioned without touching the fourth, as it would have done had all four been properly prepared to the same depth. But it may be said that such a discrepancy as that just named could not occur in practice; and this I am ready to admit, for the measurements have been purposely exaggerated in order that there may be no possibility of a mistake in even the greatest novice understanding what is meant. Although a difference of $\frac{1}{4}$ in. has been mentioned, one of even half that might be equally prejudicial. As a further exemplification of the same principle of faulty work, let us assume that instead of the whole of the rabbet of one side of the frame having been cut wrongly, it is only irregular in depth at one part—for example, that at the angle one of the pieces is not quite on the same level as the other—and it will be evident that in this case also the glass cannot bed properly. This defect is in practice much more likely to occur than the other. The remedy, of course, is to pare away with the chisel the superfluous wood, but it will be much better to avoid the necessity for doing this by taking proper precautions to have the work right in the first place. It only needs a reasonable amount of care and skill to do so. In the event of one or more sides of the frame having rabbets too deeply cut, it may be better to level them up by gluing veneer instead of cutting down the side or sides which are too high. The necessity of cleaning away any glue which may have exuded at the mitres, and become hard, must also be insisted on, for nothing is more apt to cause the glass to be fractured, perhaps because a careless worker might not notice its presence till the mischief has been done. Hardened drops of glue which have accidentally got within the rabbet must also be carefully removed. Their presence can

(*Continued on page* 42.)

Fig. 1.—Top of Glove Box in Fretwork. Designed by Robert Coxon.

Subject of Design: "Music."

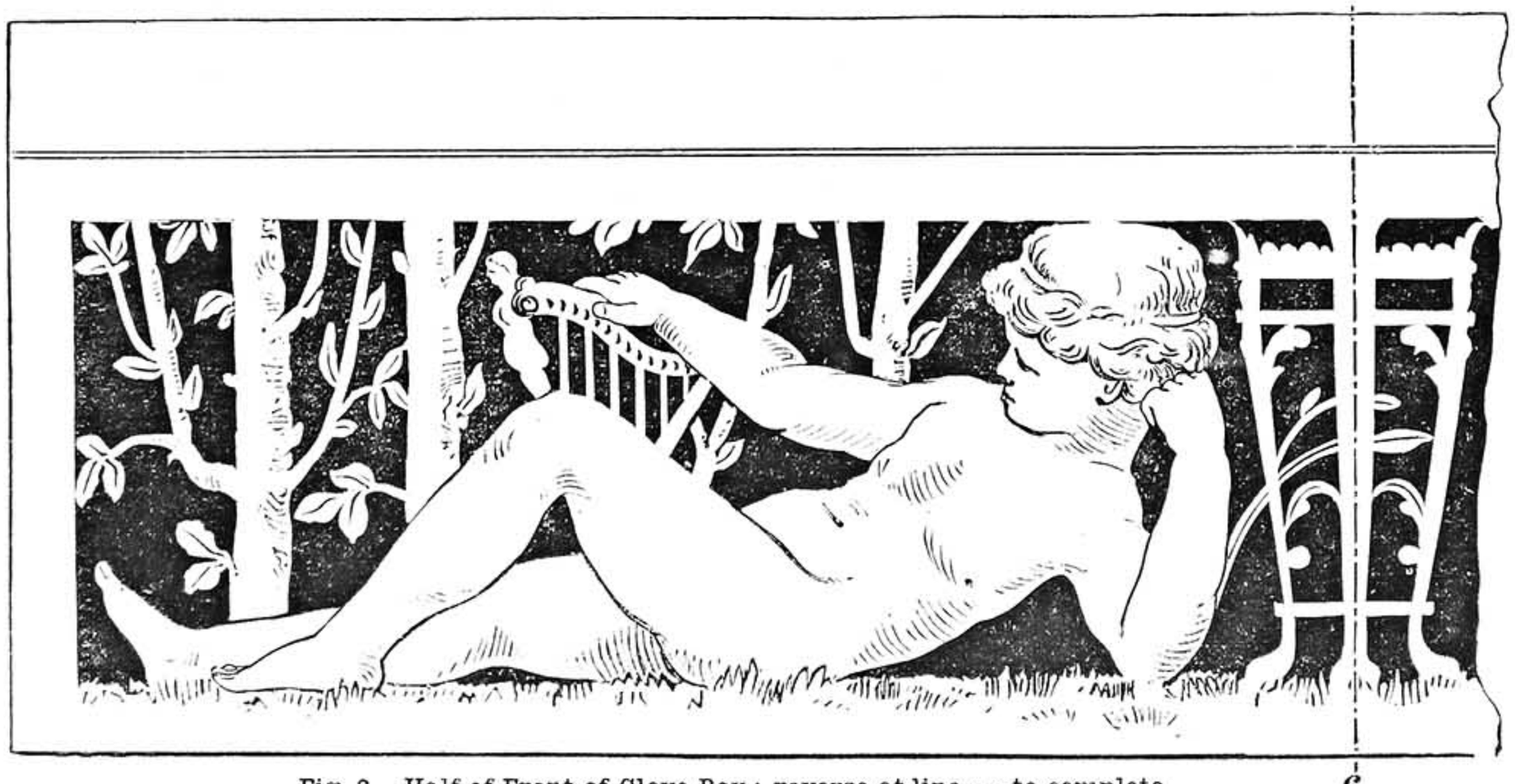


Fig. 2.—Half of Front of Glove Box: reverse at line *c c* to complete.

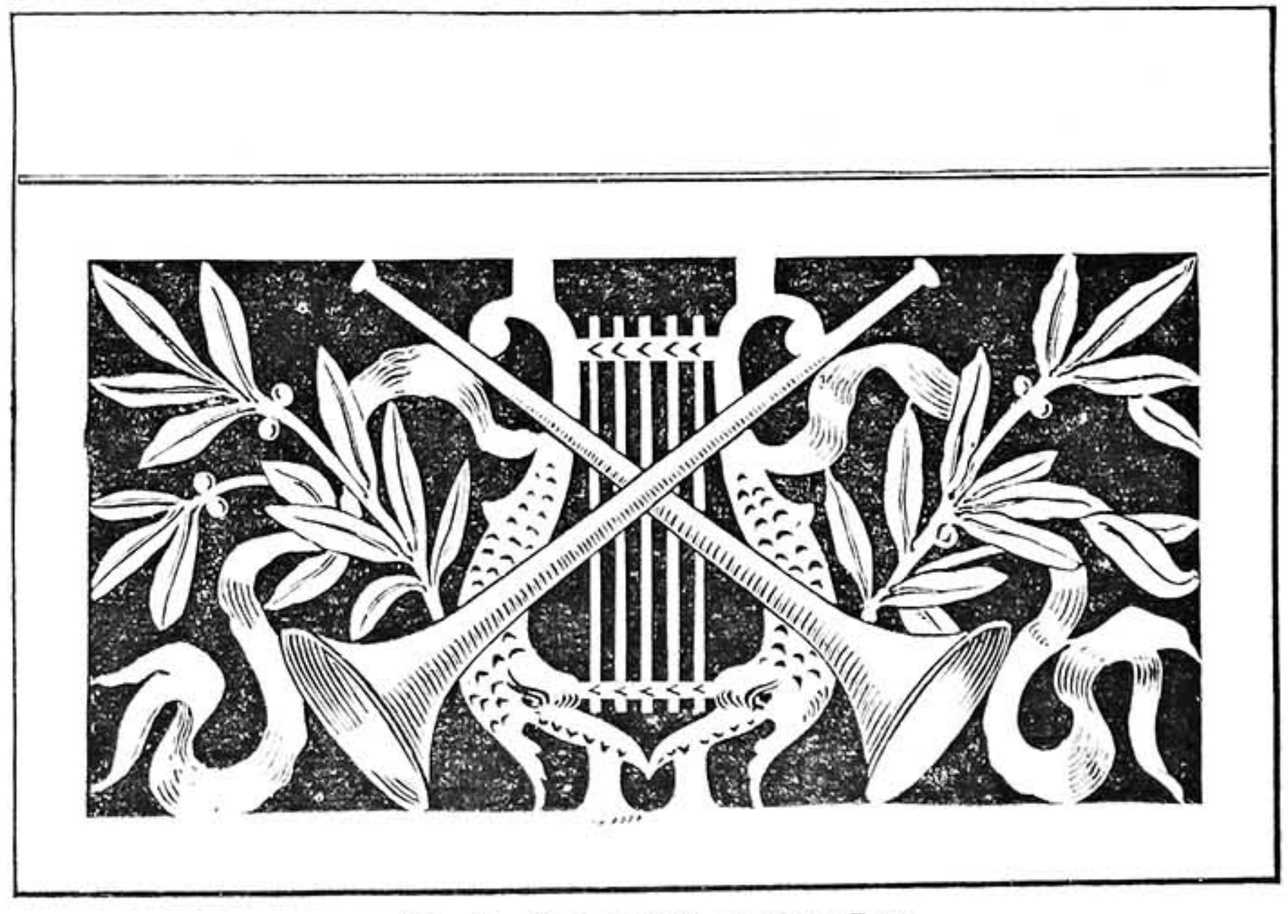


Fig. 3.—End or Side of Glove Box.

easily be ascertained by running the edge of an old chisel or similar tool along the inside of the rabbet.

Nothing further need be said about the rabbet, unless that its width is not important, provided it be sufficient to give an adequate margin to the glass. This, in the case of plain edges, may be taken as not less than ¼ in. Less would hardly do, though it may be, and often is, chanced, while more may be regarded as a waste of material, though, as will be seen later on, when treating of measuring glass, this does not necessarily follow. Plain-edged glass may or may not fill the entire space within the rabbet, as it is of little consequence whether it does or not. The same, however, can hardly be said of bevelled-edged plates, for in such cases the width of the rabbet most suitable may be stated as about ¼ in. The reason will be given later on; and in the meantime it may be well to state that as it is, from various causes, not always practicable or convenient to get a rabbet of this width, the difficulty of a wider one may easily be overcome. Whenever practicable, the depth of the rabbet should be such that the back of the glass is below the surface of the surrounding woodwork. Sometimes this cannot be managed, but with a little forethought it generally can be—except, perhaps, in very small thin fancy frames, when the thin patent glass comes in handy.

The measurement of glass for furniture is by no means an unimportant item for the cabinet-maker to observe, not only in getting the actual measurement for the glass-cutter, but in setting out the work. A very short space will show the reasons for this. As is well known, glass is sold by the foot superficial. It is not, however, sold at one uniform rate per foot, irrespective of size, as the rate increases very considerably per foot as the plate increases in size. Thus the price might be, let us say, 2s. per foot super. for plates not over 2 ft., while a plate measuring 15 ft. might be charged for at the rate of 3s. 6d. per foot. It is, further, the custom to reckon a fraction of an inch as a full inch. Thus, a plate measuring 1 ft. on each edge would of course be charged at its actual superficial measurement of 1 ft., but if the dimensions of the plate are, say, 12¼ in. by 12⅜ in., it would be reckoned as a 13 in. by 13 in. plate, containing 1 ft. 2 in. super. Now, supposing that there is a rise of a few pence between the rate for under one foot and that for under two feet, it will be seen that for the sake of the two small fractions of an inch (which it is quite conceivable to suppose might have been dispensed with had a little ingenuity been exercised when setting out the working drawing) a considerably greater cost has been incurred, with only a very slight advantage in the size of the glass. In such a small size as has been named for the sake of illustration, the actual difference is neither here nor there, but it must not be forgotten that the same rule holds good whatever the size of the plate; and if this is a large one the difference in cost may be considerable. The cost of plate glass, whether transparent or silvered, is always by the foot superficial, but when it has bevelled edges an additional calculation must be taken into account. The cost of the bevelling depends on the width of the bevel, reckoned by ⅛ths of an inch; thus, when ordering or asking for quotations, it is necessary to specify ½ in., ⅝ in., or ¾ in., or whatever the desired width of bevel may be. This is reckoned at so much per foot-run, taking the edges of the plate all round, so that on a plate measuring 1 ft. on each edge there are 4 ft. of bevelling, which must be reckoned separately, and added to the cost of the glass otherwise. The custom of charging for fractions of an inch in the bevelling varies, but perhaps the usual plan is not to reckon anything under half an inch, and to charge anything above that as a full inch. Some dealers, however, charge all parts as a complete inch. The difference, in any case, is very trifling. For ordinary articles of furniture, and for moderate-sized plates of, say, anything under 2 ft. square, a ¾ in. bevel is suitable, though, if the extra cost be not objected to, it may be very well a ⅞ in. or 1 in. bevel. A great deal depends on circumstances, for there is absolutely no rule to go by, unless it be that the cheaper class of furnishing houses always, for very obvious reasons, have very narrow bevels on their glasses. When the rates for bevelling are quoted by a beveller or dealer, it must always be understood that the figures apply only to rectangular or round shapes, for fancy shapes, with inward curves or corners, are always charged considerably higher. Thus, it must not be expected that the ordinary rate would apply to such shapes as those shown in the diagrams that are given in page 40. The reason of this is on account of the increased risk of breakage during the process of bevelling. It not unfrequently happens that the beveller objects to give any quotation for such work, but charges for it correspondingly to the amount of breakage which has happened. In other words, the bevelling of irregular shapes must be done at the customer's risk. When a quotation is given, the customer may be pretty well sure that it is sufficiently high to cover the beveller's risks. Circular or oval plates are generally calculated for as if they were square-cornered, the longest measurements in each direction being taken.

In case the word "rate," which has been several times mentioned, might mislead any readers by inducing them to believe that a uniform tariff is adopted by all bevellers, silverers, and glass-dealers or merchants, let it be said that there is no uniform standard of prices, especially for bevelling and silvering. For the glass itself, there is a kind of standard or agreement among some, if not all, of the leading plate glass houses; it is, however, not rigidly adhered to, and the occasional or amateur buyer can hardly expect to be put on the same terms as the constant buyer for trade purposes. Occasionally a wholesale house may be found who will execute a retail or amateur's order, but the prices will naturally be more than for extensive or regular trade orders. It will therefore seldom or ever be to the advantage of the amateur to take much trouble to get in communication with the firm who actually supplies the glass and does the bevelling and silvering, for he will probably save nothing by so doing. Glass bevellers and silverers do not exist in every town of even a large size, but there are few without a good cabinet-making shop to which glass is supplied wholesale, either from London or elsewhere. Mind, when I say cabinet-makers, I do not mean mere house-furnishing dealers, because there are plenty of so-called cabinet-makers who manufacture little or nothing of what they sell, and they can seldom supply the amateur with glass at a reasonable price. Let him, however, go to an actual manufacturing firm of cabinet-makers who are in direct connection with a glass house, and he will probably find that he can do better than by buying direct himself. This applies especially to those who may be living in a place to which the prepared plates have to be conveyed by rail or other carrier: for the simple reason that perhaps the retailer gets several plates sent down at once, and by that means considerably reduces the cost of carriage on each. A single plate sent in a case by itself would cost nearly as much for carriage as if several more were packed in the same case. As plates are generally silvered and bevelled after they have been ordered—*i.e.*, they are not kept in stock—it is necessary to give the order several days before the plates are required for use. From a week to a fortnight may be considered a fair time to allow. I have purposely refrained from giving any scale of prices, because these, on account of difference in quality and the various rates of carriage between the nearest wholesale dealer and wherever the purchaser may reside, could only tend to mislead. Any would-be buyer can easily ascertain the price at which he can be supplied in his own neighbourhood. It will be sufficient for him to name the size of the plates he requires, with the width of bevel, without troubling himself to know the rate per foot.

Having now given a few hints about glass as applied to furniture, the next thing will be to describe the actual fixing within the frames of the various kinds which are likely to find their way into the workshop. This, however, must be deferred to a future occasion.

SOME RULES FOR CONTRIBUTORS AND CORRESPONDENTS.

To save trouble all round, Contributors and Correspondents, present and future, are earnestly requested to note and observe the following Rules, laid down for their guidance, and to adhere to them strictly. Compliance in every particular will save much unnecessary loss of time and waste of material and money in sending back through the post letters, articles, and drawings, to have such things done to them as have been left undone by the writers.

And first let me address Contributors who from time to time have been sending, or intend to send, papers for publication in WORK; pointing out to them that the first paper on "The Violin: How to Make It," which appeared in No. 105, is, in every way, as far as arrangement goes, a *model paper*, showing throughout the proper way in which to write articles for WORK. To this paper contributors are, and will be, referred, should occasion require me to do.

1. **Syllabus of Contents.**—The title of each and every paper must be followed, *first* by the name or *nom de plume* of the writer, as preferred by him or her; and *secondly*, by a brief synopsis or syllabus of the contents of the paper, comprising the sectional divisions of the subject matter of the article, and the subdivisions into which each sectional division is further divided. The title of the sectional division should form a side heading to the first paragraph of the section, to be set in a black letter as the side heading to this paragraph. Each subsequent paragraph of the section commencing a new subdivision should have its title, as a sub-heading, to be set in *italics*. It is desirable that sections should be broken up into paragraphs as much as possible. This mode of treatment will be found to facilitate reference, and, in a great measure, to cause each article to carry its index with it. Articles for printers should be written on *one side only* of the paper.

2. **Illustrations.**—Illustrations in every case must be drawn on separate paper, and not mixed up with the text in the manuscript, for the manuscript, if accepted, is sent to the printer, and the illustrations to the engraver. Every illustration must have its *inscription* written clearly beneath it, setting forth its number, as Fig. 1, Fig. 2, etc., and showing what it is intended to represent.

3. **Length of Articles.**—For the sake of variety of subjects and to interest as many readers as possible in each number, *ceteris paribus*, preference will always be given to short articles. Papers should range from one column as a *minimum*, to five or six columns as a *maximum;* and illustrations from one-eighth of a column as a *minimum*, to one page as a *maximum*, where the cuts are numerous or necessarily large. Contributors, however, should seek to attain a happy medium, and, whenever possible, to avoid reaching the maximum, either in subject matter or illustrations.

*** *In future, all Papers and Drawings in which these Rules have not been complied with will be returned to the senders for the insertion of omitted matter. The writers of accepted articles now in the Editor's hands must do what is requisite in the slip proofs of such articles, when sent to them for revision.*

A few words may now be addressed to Correspondents who write letters to appear in "Shop," or put questions therein, and to those who write answers to such questions.

1. **Letters.**—Let all letters be brief, and kept as closely to the point as possible. No personalities of any kind can be admitted.

2. **Questions.**—These should be put in as few words as possible, and every question should be written on a separate piece of paper, because questions on different subjects are, as a rule, sent to different persons for reply.

3. **Replies to Questions.**—In answering questions, the replies must be made as brief as possible. In replies running to considerable length, all redundant matter will be struck out, or the answer will be returned to the writer for reduction in length. When an answer cannot conveniently be compressed into a small compass, it is better to obtain permission from the Editor to treat it in the form of a short paper.

4. **Illustrations.**—These must be avoided in "Shop" as much as possible. In future, only such illustrations as may be positively necessary will be accepted.

*** *It must be understood that the preceding Regulations for Correspondence in "Shop" are necessary in order to lighten the pressure on that department of* WORK, *and to enable Replies to Questions to be given far more quickly than at present.* THE EDITOR.

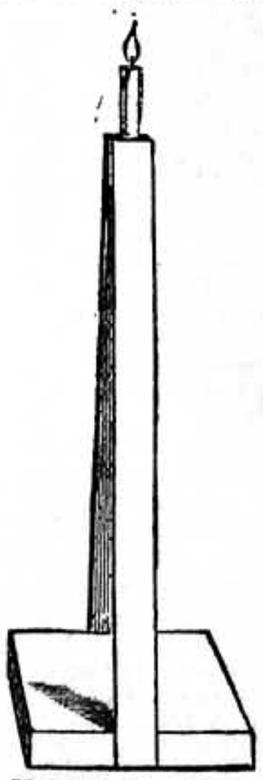
SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

I.—LETTERS FROM CORRESPONDENTS.

A Useful Candlestick.—W. J. F. (*Cork*) writes:—"The article here described does not claim to be ornamental, but I think there are few tradesmen or amateurs who would not at one time or other find it *useful*. We often hear the request from a worker for 'somebody to hold the candle.' This article, without altogether doing away with the necessity for 'somebody,' will do so in some cases, and that is an advantage. Its construction is simplicity itself. It consists of a base and two sides. The base may be any piece of waste wood, say, 10 in. by 4½ in. by 1½ in.; and the sides, say, 3 in. by 2 in. by ½ in. Of course, the sides may be as long as desired, and of any proportions; a higher candlestick would require a larger base. The long edges of the base will be bevelled slightly towards the top; a ¼ in. of bevel will be enough for the measurements given. The sides are then nailed on to the base, and left loose at the top. It will then be found that they have a spring at the top strong enough to hold a candle. The inner parts that grasp the candle should be hollowed slightly with a gouge. The candle can be pushed up or down easily, and will remain in position. Thus you can make a candlestick of any height—8 in. or 9 feet if you wish. A smaller size, about 11 in. high, is very handy for bench use, and a great improvement on the 'piece of wood and four nails,' an arrangement which does duty in so many places."



Useful Candlestick.

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

Relief Stamping.—JOINT.—The specimens which you send are all very good. In the larger ones, where the line and a few of the letters are broken, the fault is but trifling; it may arise from several causes. First, the die may not have been properly filled up with colour. Use a good stiff brush, and daub well into the die. Secondly, your method of "wiping" or cleaning may be at fault. Try the old-fashioned style of "wiping" on paper, and, if possible, use hard paper—waste of cream-laid paper. Avoid thin "printing." Be sure that your "matrix" is sharp. The die itself might want "picking out" or touching up. I am inclined to think that your matrix has not been sharp enough. You will find this out by looking at the reverse side of the stamped sheet. The impression will appear lighter at the faulty parts.—G. C.

Venetian Blinds.—BENEDICT.—The rollers for the action may be obtained of any ironmonger, or at an upholsterer's warehouse. The article promised will soon appear.—B. A. B.

WORK Index and "Shop."—There is published a complete Index to Vols. I. and II. The "Shop" supplements are already paged.

Speaking Machine.—H. M. W. (*Blackpool*).—You want to know how to make a "speaking machine" in the simplest manner. Perhaps the article on the "Phonograph," which is to appear shortly, will take your fancy.—W. D.

Glass Writing.—A. H. (*Stratford, E.*).—The following matter on writing on glass is to be found in "The Art and Craft of Sign Writing," by Mr. Wm. Sutherland:—Chap. VII., Decorating on Glass; Chap. VIII., Gilding on Glass; Chap. IX., Gilding on Glass (*continued*); Chap. X., Gilding on Ground Glass, etc.; Chap. XI., Gilding and Ornamenting on Glass (the application of printing processes); Chap. XII., Embossed and Figured Glass; Chap. XIII., Embossing and Etching on Glass with Acids; Chap. XIV., Embossing Flushed Glass; Chap. XV., White Acid Method; Chap. XVI., Another Method of Embossing on Glass. If you require a copy of this work, you must hurry up, as there are only about forty copies left, and the book will not be reprinted. Queries cannot be answered by post.—H. L. B.

Lacquering.—C. B. (*Huddersfield*).—There must be something radically wrong somewhere if, as you say, you *invariably* get your lacquering streaky. This is often due to the separation of the brush—that is, the hair of the brush, etc., instead of keeping in one broad surface, spreads out in two or three portions pointed at the ends; the parts between the points thus do not get their share of lacquer. You can easily see if this is the cause in your case; if so, get better brushes, with a good body of hair in. The best "wrinkle" I can give you is to go in for the new American substitute for lacquer, which is now used by most of our leading brass manufacturers. It is called "Zapon," and is sold by the Fredk. Crane Chemical Co., 22, Newhall Hill, Birmingham; and Short Hills, New Jersey, U.S.A. I find it far superior to ordinary lacquer, both in ease of application and also in appearance, which is the chief thing after all; for, as you say, it is annoying after getting an article up to perfection, to spoil it in the lacquering, but with zapon there is very little fear of this, and the article looks just as handsome after lacquering (or zaponning, as it is termed) as it did before. For figured work especially it is suitable, as it preserves the finest hair-lines in all their metallic sharpness. It does not "set" so quickly as lacquer, which is an advantage on plain, highly polished surfaces, such as you speak about. I have no doubt that, from the reading of this, many will try a sample, as lacquering seems a "crux" for many; and, therefore, I append a few instructions for its use, trusting they will prove of service to you and others who may read them. In the first place, it is very important that as much care should be taken in cleaning the work, and freeing it from all grease, polishing material, etc., as in ordinary lacquering; and the zaponning should be done in a room which is free from dust and draughts, and the articles should not be handled, as the fingers leave marks on the polished surface, and grease as well. Articles to be zaponned do *not* require to be heated, another great advantage, but it is best applied in a warm room, and the articles should not be quite chilly. There are two ways of applying zapon—viz., by "dipping" and by "brushing." It is recommended to dip all articles that will admit of so doing, but in cases where, from consideration of expense or from the size of the article this is not practicable, brushing may be resorted to. In this case, the zapon should be flowed on with a full brush, care being taken not to brush over any part a second time until it has become dry, when any part that has been missed may be touched up again. Wave marks or brush marks will entirely disappear when dry. Should the articles peel after coating, the cause is grease. The foregoing remarks apply to "Dip Zapon." "Brush Zapon" should be applied as thin as possible; therefore, wipe the brush free from all excess, the same as in ordinary lacquering. Brush once only over the surface to be covered, and allow it to dry; a second coat may then be given if desirable, but it is not necessary if the work is covered. It can be had colourless, and in various colours, gold, green, etc., etc.—R. A.

Bird Cages and Wire Baskets.—KENT COAST.—Consult the Index to WORK, Vol. II., for Bird Cages. Wire-working in all its branches is treated in this volume, and commenced in No. 105 of WORK.

Speaking Tube.—J. McD. (*Glasgow*).—You need have little fear of your speaking tube not acting, provided you take care to fit it up properly. Use good tubing, about ¾ in. internal diameter. Be sure that the joints are quite sound and air-tight, and that the interior surface is quite smooth. You could, of course, use telephones, but they would be much more costly. A complete installation, including bells, switches, etc., would cost £5 or £6. Messrs. Cox & Co., 11, Fetter Lane, would supply you with all requirements for the above sum: you could easily fit them from their instructions.—W. D.

Paper Cap.—CARADOC.—It is extremely easy to make these caps, but extremely difficult to explain clearly how it is to be done. However, with the help of diagrams, I hope to be fully understood. First, make the paper exactly square, three times the size of the crown—thus for 7 in. square cap, the paper must be 21 in. by 21 in.; for 6½ in. cap, 19½ in. by 19½ in.; for 6 in. cap, 18 in. by 18 in. Now spread your paper flat out before you as in Fig. 1, and on the diagonal line A B fold the point C on D, crease it, and again spread out the paper flat; and in like manner on C D fold the point B over A, crease it, and flatten out again. Secondly, fold the square into thirds, first on the line E E, and next on F F (see Fig. 2); then fold the strip again into thirds on G G, H H (see Fig. 3). Now spread the paper out flat. It will then be seen that the square G G, H H will form the future

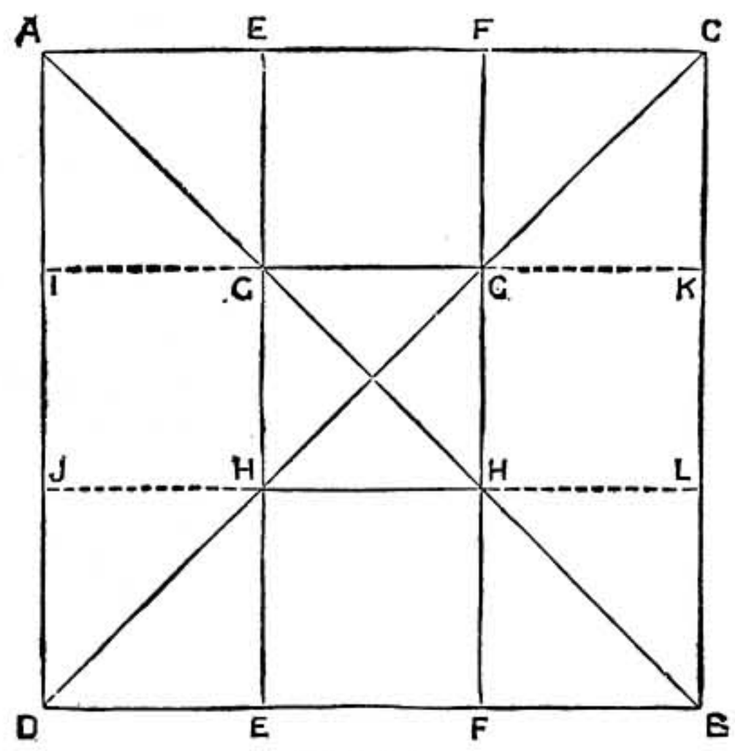


Fig. 1.

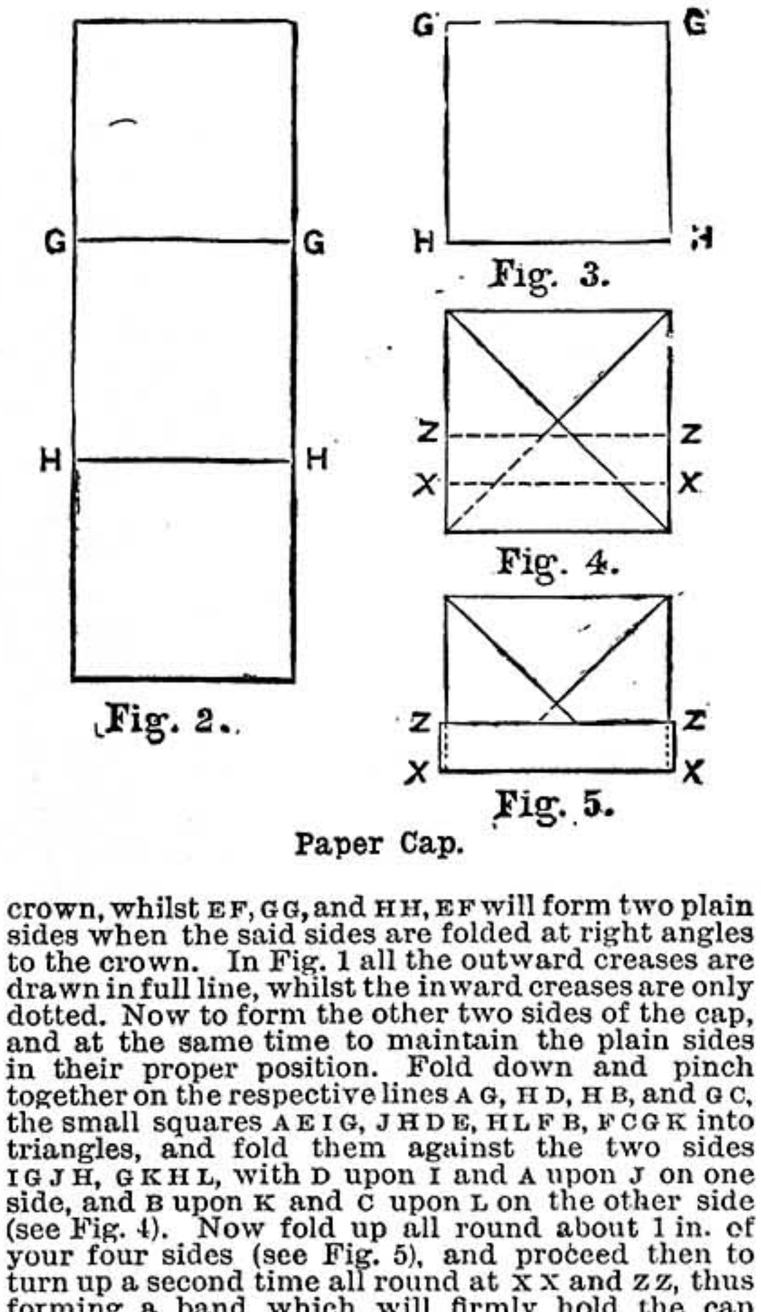


Fig. 2. Fig. 3. Fig. 4. Fig. 5.

Paper Cap.

crown, whilst E F, G G, and H H, E F will form two plain sides when the said sides are folded at right angles to the crown. In Fig. 1 all the outward creases are drawn in full line, whilst the inward creases are only dotted. Now to form the other two sides of the cap, and at the same time to maintain the plain sides in their proper position. Fold down and pinch together on the respective lines A G, H D, H B, and G C, the small squares A E I G, J H D E, H L F B, F C G K into triangles, and fold them against the two sides I G J H, G K H L, with D upon I and A upon J on one side, and B upon K and C upon L on the other side (see Fig. 4). Now fold up all round about 1 in. of your four sides (see Fig. 5), and proceed then to turn up a second time all round at X X and Z Z, thus forming a band which will firmly hold the cap together.—J. W. H.

Scene Painting.—FRETWORKER.—Articles upon this subject have already appeared in Vol. II. The other subject you refer to will be treated in due course.

Poles of Magnetic Needle.—AMATEUR.—You are quite right. The north pole end of the compass needle is, strictly speaking, the north-seeking end of the needle, and is therefore the south pole of the magnetic needle employed in the compass. But this end, by common consent, is regarded as the north pole of the needle, and the relation of other magnets to this is determined accordingly. In converting a steel bar into a bar magnet by enclosing it in an electrical solenoid, we regard the end to the left of the course of the electric current as the north pole end of the magnet.—G. E. B.

Charge for a Voltaic Battery.—R. L. (*No Address*).—If the battery is intended to be a Bunsen, charge the cell containing the zinc with one part sulphuric acid in from eight to twelve parts of water. Allow the mixture to cool before placing it in the cell. Charge the cell containing the carbon with strong nitric acid—no water in this. The acids must not be mixed together. The carbon plates should go in the porous pots with the nitric acid, leaving the outer and larger pots for the zinc cylinders and the mixture of sulphuric acid and water.—G. E. B.

Rendering Parchment Transparent and Waterproof.—BANNERMAN.—So far as I understand his requirements, I imagine that BANNERMAN might get what he wants by following the process sometimes resorted to for making imitation oil paintings from old mezzo-tinto engravings. To do this, the back of the print is covered with repeated coats of *mastic* varnish till it becomes transparent; oil colours, chiefly in flat tints, are then laid on the back. The best advice I can give to BANNERMAN is to try the mastic varnish in this way. As I do not know his purpose, I cannot say positively that this will give as much transparency as he requires, but I presume that it will; and it will certainly make the parchment waterproof, without impairing its strength, which are points upon which he insists. Of course he must take care that his parchment is of uniform thickness, or it will not appear equally transparent in all parts.—S. W.

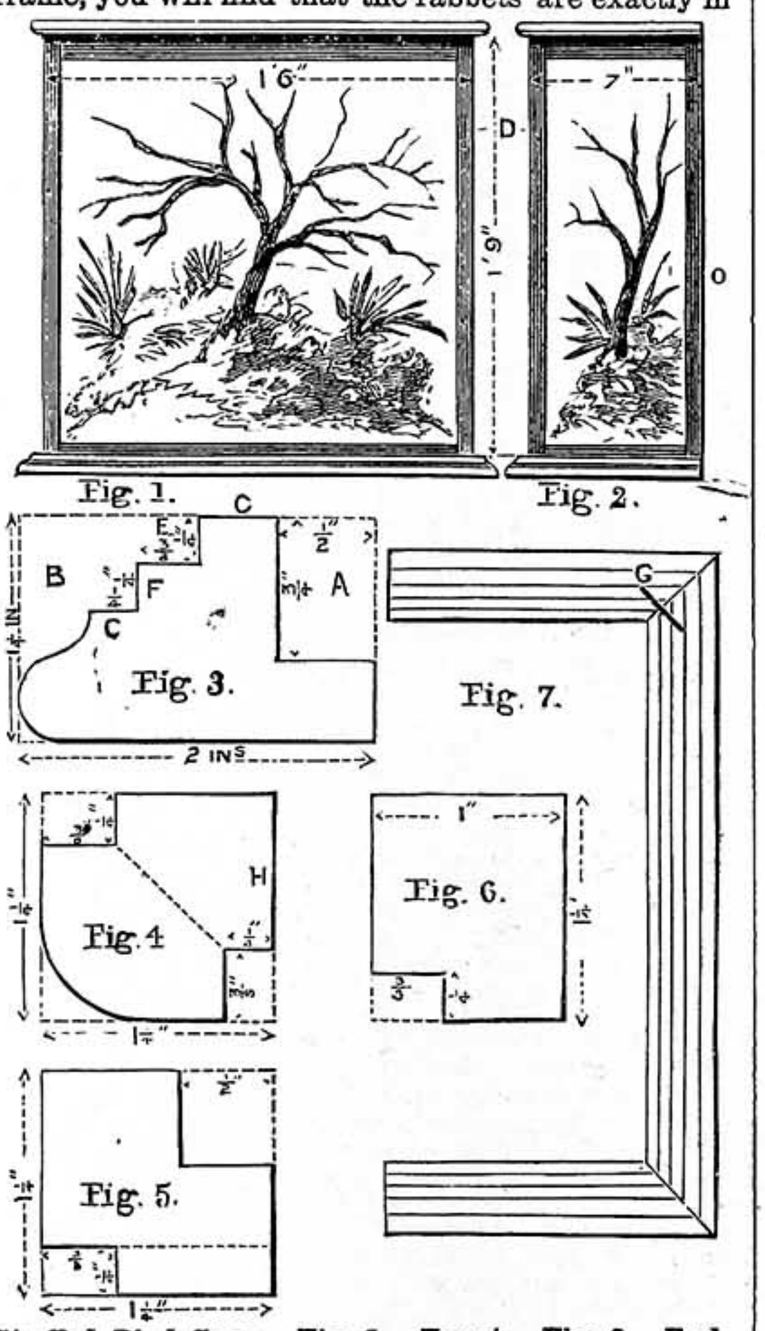
Alarum Clock.—C. K. (*Mildmay Park, N.*).—Take out the movement, and on the arbor that carries the alarm hand (that is, if a lever; you do not say if a lever or pendulum) between the plates is generally a spring to hold the arbor tight. This spring may have got loose by the pins coming out; if so, pin it up tight. Or perhaps the wheel that rides loose on the arbor, and has a notch cut in the edge of the collet or sleeve, and is pressed against a pin going through the arbor, gets fixed in rising up the slope. Smooth the slope up nicely, also the pin, and put a little oil, then try. Or perhaps the arm on the hammer is bent down out of the way of the hook or up too hard against it. I think you will find one of above faults with it.—A. B. C.

Enamelling Metal.—J. P. (*Bethnal Green*).—The so-called enamel, such as is applied to bicycles and tricycles, is simply a fine japan, but enamel has somehow a better sound, or is considered a more taking name, so I suppose that is why the vendors of such articles so term it. Such being the case, we naturally arrive at the conclusion that it is applied in the same way. And as to the question whether it is too difficult for an amateur, that depends upon whether the amateur is prepared to go to the expense of erecting an oven large enough to stove the parts in, for this is the secret of good enamelling, or japanning, whichever you like to call it. If, as is most likely the case, you are not prepared to do this, there are for your choice the various articles advertised for this purpose, such as Foochow, Guest's, Aspinall's, etc.: you will find their prices and addresses in any issue of the cycling papers. They answer their purpose fairly well, but are not to be compared with stoved work. I am a bit of a cyclist myself, and when my "steed" requires a fresh "coat," I purchase a little best black japan (*not* Brunswick black) and a little of the best carriage varnish that I can get for money. Two coats of the black and one of varnish, and I have a nice-looking machine again, and the renovation costs not more than 1s. 6d., and lasts a whole season, which is as long as I care for. Moral—Go and do likewise.—R. A.

Lamp for Box Battery.—A SUBSCRIBER.—I infer your lamp to be a 10-volt 8 c.p. incandescent electric lamp. As you cannot light such a lamp with current from a small 4-celled box battery, the fault lies more in the selection of lamp than in the construction of the battery. The lamp should only require from 6 to 8 volts—six, rather than eight—but not higher than the latter figure, or you will get no light at all. Mix the bichromate of potash solution with the sulphuric acid in a stoneware jar, and allow the liquid to cool before placing it in the cells. The brass tang may be soldered to the zinc if the joint is well made, and the lead heads for the carbons may be square instead of round, without in any way interfering with the working of the battery. Add another cell or two to your battery if you are going to use the same lamp, and you will then get a light from it.—G. E. B.

Drilling China.—H. P. (*Brighton*).—The best and easiest way is to drill with a chip of diamond set in a tube, and used with a special drill, such as is illustrated in the article upon "China and Glass Riveting" in No. 53 of WORK. Read this article, and if it is such work you wish to undertake, you will, I think, gather some useful hints from it.—W. E. D.

Stuffed Bird-Case.—F. M. (*No Address*).—I send a sketch of bird-case. To make it, proceed as follows:—Procure a piece of pine 3 ft. 4 in. long, 2 in. wide, and 1¼ in. thick, and plane it up, then run a rabbet ½ in. wide and ¾ in. deep (as per sketch A, Fig. 3) for the bottom board to rest in; then run the rabbets and mould as Fig. 3, B, then procure a piece of pine 1¼ in. square, 7 ft. 6 in. long; cut off a piece 3 ft. 7 in. long, and after planing up square, run a rabbet ¼ in. by ⅜ in. down each side as per sketch (Fig. 4), then take the other piece and rabbet it ¼ in. by ⅜ in. down one side only, and down the other a rabbet ½ in. each way; this is for the back to rest in (Fig. 5). Get another piece 3 ft. long, and plane up as Fig. 6; this is for the top frame. We will now make the framework. Take the piece of base framing and cut a piece off 1 ft. 7½ in. long with a mitre at each end, then cut two more pieces 7⅛ in. long with a mitre at one end only, and proceed to glue and nail them together like Fig. 7, with the large rabbet inside. Now take two pieces like Fig. 4, 1 ft. 9½ in. long, and cut a bit out at one end from corner to corner of each rabbet as per dotted line, and ½ in. deep; this will allow the front pillars to rest on the base frame at the points C, C. Now, if you place the front pillars on the base frame, you will find that the rabbets are exactly in



Stuffed Bird-Case. Fig. 1.—Front. Fig. 2.—End. Fig. 3.—Base Frame. Fig. 4.—Plan of Front Pillars. Fig. 5.—Plan of Back Pillars. Fig. 6.—Top Frame. Fig. 7.—Mitred End.

one place, and by cutting the corner of the base frame down to C (Fig. 3) as per line G (Fig. 7), until the front pillars are on a line with F (Fig. 3), you will be able to glue and nail them in position as shown in Figs. 1 and 2 (D, D). Now take the piece that you have rabbeted (Fig. 5) and cut two pieces off 1 ft. 9½ in. long each, and then cut them as per dotted line (Fig. 5), and ⅜ in. deep, care being taken that you do not cut the wrong end, as all the rabbets that are ¼ in. by ⅜ in. must come together for the glass to fit in. Now, if you put the piece on Fig. 7 with the rabbets in place, you will see that you can cut a piece out of the end of the base frame end 1 in. long and ½ in. deep, which will let the ends of the back pillars rest on C, C (Fig. 3), the same as the front pillars. Now take the piece of top frame and cut a piece 1 ft. 4 in. long, and cut a piece out of each end ¼ in. long and ⅛ in. wide from the back; this will allow it to fit into the rabbet of the front pillars and also the back of the same at H (Fig. 4). Now cut two more 5 in. long for the ends; cut them the same as the front, and glue and nail all firmly together. Now take a piece of ½ in. pine, 1 ft. 7¼ in. long and 7⅛ in. wide, plane it up, and round the edge off on three sides, leaving the back square. Now proceed to glue and nail it on the top, letting it project ⅛ in. on the front and sides only, and you will have frame like Figs. 1 and 2. Now take a piece of board and fit it in the rabbets of the base frame in the inside for the bottom of the case, then procure sufficient board to make the back, and let it just drop inside the rabbets of the back pillars, so that it will come flush with them at O (Fig. 2). You can now use your own taste in blacking or gilding the frame, but if the front pillars are stop-chamfered and picked out in gold, with the other parts ebonised, you will be quite satisfied with the looks of the case. Now put in the glass, or you can fasten in the back, covering it with calico stretched tight to paste the paper on, and after pasting the paper on and distempering the back and top and the inside of the front pillars, you may make your rockwork or tree on a separate board and slip it inside the case, fastening it down with screws. You can now bead in your glass and black the back of the case with glue and lampblack. Of course, you can use your own taste for the front pillars, but I do not like turned ones; they are not as neat as one that is stop-chamfered and beaded like the moulding you buy in black and gold.—J. A. W.

Stain.—S. S. (*Salford*).—To stain birch a mahogany colour is not difficult. As good a stain as any for the purpose is a decoction of logwood chips in water. Test the strength on a piece of waste wood before using it on anything of value. Your question about matching up teak is one that cannot be answered satisfactorily, for in this class of work no definite directions can be given. One might just as well ask how an artist gets effects in a picture, and then expect to do the same when one gets to know the paints he uses, without having any knowledge of the art of painting. Matching-up is an art which may to a certain extent be learned under a good teacher, but hardly at all from verbal instruction. I should experiment with those pigments which seem most likely to give the tints you want, and carefully note the results. The various shades of brown are most likely to be useful to you.—D. D.

Ebonite. W. A. N. (*Forest Hill*).—I do not know of any material by this name, but from your description it is probably the same as vulcanite. If so, it can be got from any shop where indiarubber goods are sold. It can be cut with a saw and other tools. I presume you want it for fret-cutting. It is not very pleasant to work with—at least, not so much so as xylonite, with which there is not the slightest tendency to chip. However, your best plan will be to get a small piece of each, and, by trial, ascertain which of them suits you best.—D. A.

Varnishing and Polishing.—T. B. (*Dodworth*).—What you ask for are apparently full directions for both polishing and varnishing, as well as staining—in fact, a complete guide to the work. To give this is, of course, out of the question in "Shop." As you say you are quite unacquainted with the art of polishing, I am afraid I musk ask you to wait a bit before your wishes can be gratified; but in the meantime, you will do well to read over the numerous hints on the subject which have already appeared in these columns. Perhaps it may be of assistance to you to recommend you to buy stains ready made, and to varnish with a brush instead of polishing with a rubber. Copal or any hard clear varnish will do for the purpose. I hope these hints will be of service to you. If you find any difficulty, let us know, and we will do what we can to help you, but it is impossible to give a novice full instructions for the practice of a difficult art in all its phases in "Shop," or even in any one number of WORK.—D. D.

Safety Cycles.—J. W. H. S. (*Sharow*).—A series of articles on this subject will appear in this volume of WORK.

Silvering by Nitrate.—G. O. M. (*London*).—There are several recipes given for this, but perhaps the two following will be as easy for you as any:—(*a*) Dissolve ten grains of pure nitrate of silver in 1 oz. of water; stir with a glass rod, and drop strong ammonia in until the brown precipitate is redissolved. Make separately a solution of ten grains of Rochelle salt in 1 oz. of water. Clean the glass well, and warm by the fire or in the sun; make a wall of putty, beeswax, or other suitable substance round the edges to prevent the liquid flowing off. When ready, pour on sufficient of the two solutions to cover the glass to a depth of about ¼ in., using two parts of the nitrate to one part of Rochelle salt. Let it stand, if possible, in the sunshine for an hour or two, until the silver is deposited; then pour off what remains, and wash four or five times with soft water; let it dry, and finish by varnishing either with equal parts of beeswax and tallow, or one composed of gum dammar, twenty parts; asphalte, five parts; gutta-percha, five parts; and benzine, seventy-five parts. This latter sets very hard. (*b*) Dissolve 1 oz. of nitrate of silver, ½ oz. of spirits of hartshorn, and 2 oz. of water; filter; then add 3 oz. of spirits of wine or naphtha, and about twenty-five drops of oil of cassia; let it remain a few hours, when it will be ready for use. Prepare the glass in the same way, and pour on the solution; then drop into it, in different places, a few drops of oil of cloves and spirits of wine (one part of oil of cloves to three parts of spirits of wine). The more oil of cloves the quicker the deposit, but too much should not be used. Finish off in the same way as in the first recipe.—W. E. D.

Mould for Lead Heads.—H. F. F. (*Hackney*).—The mould for the lead castings on the heads of carbon plates used in Leclanché cells may be made of any moulding material, such as sand, loam, or plaster of Paris. Get an old carbon, and use the head of this for a pattern. The carbon plates have the heads cast on them head end downward, resting on the tang of the binding screw thrust into the bottom of the mould. An iron mould, cast to the shape of the lead head, will turn out the sharpest and best finished castings, and can also be worked at a faster rate than moulds made in sand or in plaster of Paris.—G. E. B.

Carbon Plates.—F. W. (*Addlestone*).—If the gas retort carbon is dense, close-grained, and hard, the plates cut from it will do equally well with those bought elsewhere. Use an old saw or one improvised from hoop iron, plenty of wet sand, and elbow grease without stint. It is a dirty and a laborious job.—G. E. B.

Slides of Brass Wind Instruments.—YORKIO.—Heat the outside of the slides over a gas jet, taking care not to fuse the solder. Pour a little *oil* (not paraffin, which is not a good lubricant) on the junction of interior and exterior slides. When the oil has been drawn in through the action of the heat, pass a narrow slip of stout linen or canvas through the bow of slide, and fix the ends in a vice, or tie them round some fixed object; then pull the instrument steady and firmly. If the slide cannot be now drawn, the bow must be unsoldered, and each side be attacked separately. For this purpose a small mandrel (which can be made in wood), to fit tightly the bore of slide, is required. When inserted in the slide, it should project sufficiently to give you good purchase. Then, after again heating and oiling, try and turn the slide, drawing it at the same time firmly toward you. Should this fail, there is probably a bruise in the slides, and it is a case beyond amateur curing. Send the instrument to the maker. If the bruise cannot be taken out by acting upon the suggestions given on page 780 in No. 100, you had better send it to a maker. Any attempt to straighten the bow of bell would almost certainly result in cracking the tubes; and even if you succeeded in escaping this danger, you could not bend it back to its original shape again.—G.

Tobacco.—N. M. (*Norwich*).—Tobacco plants are raised from seed, which, in this country, is commonly sown in heat (in a frame, pit, etc.) in the month of March, the seedlings being pricked out into small pots, and not placed in the open air till the mild weather of June has set in. Or, in the open air, the seed is sown in sunny borders early in May. The tobacco plant loves a warm, sheltered spot, with a southern aspect. It is very susceptible to cold east winds. It requires a rich soil—to plant it in any other is indeed seed and trouble thrown away. It should have a deep, free loam, or ground deeply trenched with well-rotted manure. In dry weather it needs an abundance of water. For the purposes of commerce, the plants are cut when the leaves begin to change to a yellowish-green. They are first laid upon the ground to dry, the thicker stems being slit through to facilitate drying. Afterwards they are hung on poles, so that the air may have free access to them. If, as is often the case in this country, artificial heat is needed to assist, it must be of a very gentle kind. When just sufficiently dry (not so dry as to break), the tobacco is heaped together on wooden platforms to ferment or "sweat." The drying and sweating are very delicate operations, and much care and skill in them are required to produce a high-class article.—A. Y.

Silvering Mirrors.—E. T. (*Blackburn*).—Several replies have been published upon this subject during the last few months in WORK. The process is as follows:—A piece of tinfoil is covered with mercury (quicksilver); a sheet of paper is laid upon it, and the glass upon the paper, which is then withdrawn, leaving the glass resting upon the foil and quicksilver; it is then weighted down until dry. Although this sounds rather easy, in practice it is the reverse, and the larger the glass the more difficult it becomes for an amateur.—W. E. D.

Hydrofluoric Acid.—ETCHER writes:—"Can you tell me how the white acid used in glass-etching is made?"—By white acid, I suppose you mean hydrofluoric acid (H_2F_2), or fluoric acid, as it is sometimes called. It is made as follows:—Powdered fluoride of calcium is placed in a leaden retort, and twice its weight of sulphuric acid (oil of vitriol) poured upon it, and by means of a stick is made into a paste; it is now gently heated, when gas is freely given off; this must be collected in another leaden vessel containing water. The water absorbs the gas, and it is continued until it will take up no more. The water is thus highly charged with acid, and is the liquid hydrofluoric acid used in etching glass. Great care must be used in making it: the operation ought to be conducted in the open air, as it acts injuriously upon the organs of respiration. The vapours produce pain at the finger-ends, and drops on the skin act like a red-hot iron, producing painful sores; it must also be stored in indiarubber bottles, as it corrodes and dissolves glass. Should you only need a small quantity, it is far better to buy it than to make it, on account of the difficulty and danger. You ask "how the designs are put on." The glass is coated with Brunswick black, beeswax, or some other substance that will resist the acid, and the design is cut through that down to the wax. Designs are cut with wheels of different diameters, mounted in a lathe, and wetted with emery and oil.—W. E. D.

Coloured Views.—A. E. S. (*Glasgow*).—I cannot decide to what class of articles you refer when you ask for the process of producing "coloured view articles," such as are sold at "coast fancy goods stores." Now there are several kinds—some being coloured photographs, and mounted in optical contact with glass. Some small articles are simply coloured prints in optical contact with glass; others again may be printed in inks, such as common earthenware is done with. Perhaps this is what you mean as you mention ink. How did you make your ink? Did you use metallic colours? None other are of any use with glass or pottery. This probably was the cause of your failing.—W. E. D.

Engine Power.—G. D. (*Sheffield*).—If there is no expansive working—that is, if the initial pressure of 60 lb. is continued to the end of the stroke—you would get, allowing for friction, about a ½ h.p. from your engine, rather under than over perhaps. By calculation, it would come out ¾ h.p.: thus,

$$\frac{\text{pressure} \times \text{area of piston} \times \text{velocity in feet per second}}{33000} = \frac{60 \text{ lb.} \times 3{\cdot}1416 \times 133 \text{ feet}}{33000} = {\cdot}75 \text{ h.p.}$$

—J.

Camera.—H. W. (*Gateshead*).—The shutter most generally approved for studio work is Cadett's Patent Shutter, which is simply a flap shutter attached to the back of the lens mount and worked by the expansion of a small bellows working between the sides of a case with a movable lid, to which the shutter is connected. The pneumatic principle of action is, of course, the same in all shutters, being the expansion in a small air-tight bag at one end of a tube by the compression of a larger one at the other. A variety is made by the propulsion of a small sealed tube from another open one, in which it slides, the sealed tube pressing upon a lever or trigger as the case may be, as in Fig. 1. The dotted lines show the indiarubber tube connected with a ball, from which the air is forced by pressure with the hand; A represents the short sliding tube with stops. The advantage of having the shutter work at the back of the lens inside the camera is that it can be used without attracting the attention of the sitter, an important matter where children are concerned. The shutter itself is made of a frame of bent wire, over which black velvet or cloth is stretched, and of a size sufficiently large to cover, and a little to spare, the lens to be used. The attachment consists of a ring of wood covered with cloth, with a loose piece that can be pressed against the lens mount by means of a thumbscrew, as in Fig. 2. The manner in which the flap is raised and lowered is that the wire framework, which

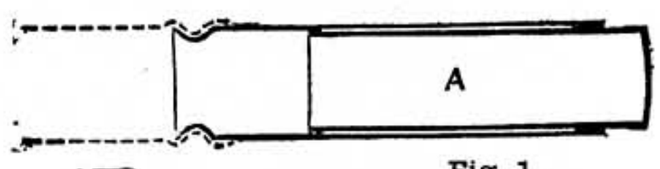


Fig. 1.

Fig. 2.
Camera Parts.

works on a bar above the lens, is brought down on one side in the form of a short lever, against which the pneumatic arrangement presses, thus raising the flap. A piece of elastic is stretched across the flap a little below its point of suspension, that immediately on the removal of the pressure brings it (the flap) back to its original position over the lens. There is a great variety of methods of utilising the air pressure and forms of shutters, but up to the present time for studio work the simple flap is preferred. With regard to the other questions, the use of hinges in sliding frame is that a longer extension of the camera may be had than if it were only the size of the solid unhinged part of the baseboard. In the diagram shown, it will be seen that without hinges the frame would prevent the closing of the baseboard, which, although not perhaps clearly shown, does fold up, the shorter piece being of the width of the front woodwork of the camera. The bent wire acts as a spring when either one or both of the shutters are in place, and the use of it is to stop out the light by pressing one of the strips of wood to cover the opening on the withdrawal of the shutter, and the spring is got by the pressure of the wire against the shutter that remains in place. If the division between the plates is too thick for the plates used, there is no objection to making it of thin zinc or other metal blackened. The buttons that keep the plates in position are sunk level with the framing. The less play between the division and plates the better, so long as there is room, making allowance for the varying thickness of the glass in general use. If metal is used, a weak spring fixed on each side is an advantage. Some prefer a piece of blackened cardboard, slightly buckled. The idea is to keep the plates in proper register by pressing them gently against the buttons in front, whatever may be the plan used to effect it.—D.

Engine, etc.—C. S. W. (*Settle*).—It will be quite sufficient to add the names of the towns only in which the firms you name carry on business, provided you put on the envelopes the nature of the business. If you want a model, you cannot do better than advertise in WORK. There will probably be an horizontal engine described in WORK shortly.—J.

Paper-Making Machinery.—H. W. C. (*Lee, S.E.*).—We do not see why the idea should not succeed, and it appears to be novel. If it does the work proposed, it would probably be worth patenting.—C. E.

Electrotyping.—ELECTRO.—(1) The wires leading from the dynamo to the vat get hot, because they are not large enough to carry the current required in the vat. The sulphate coating has nothing whatever to do with the heating. (2) If the wire from the negative pole of the machine is connected to a stout metal bar on which the slinging wires or clips of the moulds rest, and the wire from the positive pole of the machine is connected to a similar stout metal bar supporting the anodes, there should be no necessity to connect the wires at both ends. The resistance is not at these points, but in the leading wires themselves. (3) Electrotypes for the press are mounted on wood blocks, the whole being made "type-high." Electros on metal are employed for ornamental purposes. The prices charged for these are variable.—G. E. B.

Nickel Bath.—B. J. (*Dorking*).—To make up twenty-five gallons of nickel solution for plating, procure ¼ cwt. of double sulphate of nickel and ammonia. This will cost about 23s. from such firms as Messrs. J. E. Hartley & Co., 13, St. Paul's Square, Birmingham. Dissolve the nickel salt in hot rain-water, and filter it through calico into the vat; then fill up with filtered rain-water. The solution should be neutral to blue litmus paper, and have a specific gravity of 1·520, as tested by a direct reading specific gravity hydrometer. If it is acid, the acidity must be corrected by adding sufficient liquid ammonia. If the solution is too dense, withdraw some of the liquid into another vessel, and fill up the vat with rain-water. As a rule, use 1 lb. of nickel salts to each gallon of water. Work with a large surface of pure nickel anode, obtainable where the salts are to be obtained.—G. E. B.

Pencil-Holder.—PEN.—We have examined the description and sketch sent us, and it appears to be a useful and practical idea, but whether it is a novelty we could not say without a search to ascertain if prior rights have been established by anyone. There is not the least doubt but that many less promising inventions are patented daily; but before taking any steps in regard to patenting, you should make, or have made by a competent person, such a search as would decide this important point, and then you will be in the proper position to consider what you had better do in the matter.—C. E.

WORK Volumes.—FAIERO.—You should address the publishers—Messrs. Cassell & Company, Limited, London, E.C.—but the price of a WORK volume (7s. 6d.) is so small that it will be hardly worth your while to write about the cost of exchanging numbers for a volume.

Model Electric Lights.—F. E. O. (*No Address*).—Articles on the above subject appeared in WORK, Nos. 76, 82, 89, 92, 94, 97, 99, 100, and 104. They can be had through your bookseller, or from the publishers, Messrs. Cassell & Company, Limited, London, E.C.

Harmonium Reeds.—It is useless to place harmonium reeds on pipe organs, as the reeds will not keep in tune with the pipes. Change of temperature, which will lower the pitch of the pipes, will heighten that of the reeds, so that the resulting difference is considerable. The only thing practicable is to add a set of reed pipes, a small trumpet for loud stops, and an oboe or clarionet for softer tones. You do not say what stops your organ is to contain, so I am unable to advise as regards any additional flue pipes. As regards a black stain for wood, I do not think you can get anything to sink deep into the wood unless it is put on boiling hot; but perhaps some other contributor may be able to assist you in this matter.—M. W.

Marbling Colours.—W. J. J. (*Southwick*).—Marbling colours ready ground, in air-tight tubes, which I mentioned in my articles on "Bookbinding," may be obtained in large or small quantities from Messrs. Berry & Roberts, St. Bride Street, London, E.C. They vary greatly in price.—G. C.

Stitching in Binding.—NIL DESPERANDUM.—I have not the slightest idea of what you want. Here is your query: "Is there no other way of stitching other than stitching through the cardboard and buckram in bookbinding; and if so, will you kindly let me know?" Write again, and try and explain your difficulty a little more definitely.—G. C.

Stamping.—J. S. (*Amsterdam*).—You have used Dutch metal instead of gold-leaf, which is really the cause of your failure. But if you follow carefully the instructions given on the page you quote, use real gold, and use the powder supplied by Mr. W. Valters, 1, Pembroke Terrace, The Park, Salisbury, Wiltshire, you will have the best stamped silk, satin, or velvet in Europe. Do not use bronze powder or Dutch metal, which, although cheaper in the first cost, turns out the most expensive in the end. When you have tried the powder, you might report, as I would like to know if you succeed to your own satisfaction.—G. C.

Index to Vol. I.—L. K. (*London, S.E.*).—An Index to Vol. I. of WORK has been ready since the volume ended, and has been advertised many times in WORK. The price is 1d., or post free for 1½d., from the publishers, Messrs. Cassell & Company, Limited, London, E.C. The Index to Vol. II. is now ready, price 1d.; post free, 1½d.

Gutta-Percha Soles.—WEEKLY READER.—An article on the above subject appeared in WORK, No. 102. It was entitled "An Easy Method of Resoling Boots." This will suit you, probably.

"Patent."—D. K. (*Dumfries*).—Provisional protection gives no *legal* right to the use of the word "Patent." The legal right to do so is only acquired when the patent has actually been granted.—C. C. C.

Violin Papers.—J. B. (*Broomhead*).—These will be given in Vol. III. of WORK, now commencing.

Book on Practical Blacksmithing.—WASSE.—The name and address of the publishers of the above work, noticed in "Our Guide to Good Things," No. 89 of WORK, is given at the end of the notice. Write to the publishers for the price of the book.

III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Pendulum.—HORA writes:—"Will anyone give me the dimensions for a half-seconds compensated zinc and iron pendulum—viz., length of suspension spring, length of steel or iron centre rod, length of zinc tube, and length of external iron tube, the bob to be centrally supported? What thickness of the above tubes is required for a bob weighing, say, seven pounds?"

Enamelling Slates.—J. D. (*Holyhead*) writes:—"I should feel obliged if any reader would give me information of any book or treatise upon enamelling, especially slates; or, possibly someone can give me information as to how to do this work."

Coppering.—A. K. (*Edinburgh*) writes:—"Can anyone give me a recipe for a solution for coppering lead or tin?"

Hair-Sieve Bottoms.—HOOPBENDER writes:—"Can any reader oblige with the addresses of two or three makers or dealers of hair-sieve bottoms?"

Doll's House.—W. L. (*Penge, S.E.*) would feel obliged if any reader could tell him where he could buy such fittings as small door-handles, knockers, and fire stoves.

Coopering and Chairmaking.—J. S. (*Longsight*) writes:—"I should be glad to know the opinion of an expert as to what advantage there is to coopers and chairmakers in the wooden brace, etc., over the iron one used by joiners and others."

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Scrap Leather.—J. M. (*Manchester*) writes, in reply to A. F. W. (*Oldham*) (see page 829, Vol. II.):—"You ought to experience no difficulty in disposing of any reasonable quantity of scrap leather. Try Platt's or Asa Lee's in your town, who use it for case-hardening purposes. Another market for it, or any other animal membranous refuse, is the manufacturing chemist, who makes ferricyanide of potassium, or 'prussiate,' as it is often called."

Iron Lasts.—F. M. (*Ebbw Vale*) writes, in answer to W. S. (*Highbury*) (see page 830, Vol. II.), *re* Iron Lasts:—"He could get them from J. & H. Cooper, 35 and 37, Caledonian Road, and 1A and 2A, Albion Street, King's Cross, London, N.; or from W. Beaney, London. I forget the latter's full address, but he could get it from the *Shoe and Leather Record*, price 2d. They are sold both by the pair and by weight, according to the kind he wants. The former range from 11d. per pair for children to 3s. for men; and the latter, from 9s. 6d. to 15s. per cwt. Full information can be got by applying to either of the above for price list."

Hair Cloth.—H. E. (*London, N.W.*) replies to G. J. W. (*Ballymena*) (see page 830, Vol. II.):—"You can get hair cloth of Tubbs', upholsterer's warehouseman, Goodge Street, London, W. Price about 1s. 6d. per yard for 18 in. wide, to about 4s. 6d. for 36 in."

Circular-Saw Bench.—E. H. H. (*Chatham*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.):—"Let him get some 4 in. by 3 in. fir, and set out four rails in pairs, for three uprights—one in middle, and others about 9 in. from ends; then brace from top of middle stile to bottom of end stiles; then mortice and tenon a piece across top and bottom of ends, and your framing is complete, although for heavy work the ends should be braced. Use 4 by 2 for braces; for top, get some 1½ by 9 fir, and screw down to framing, and then cover with stout sheet iron, screwed down. If S. P. gets a list from Reynolds & Co., Britannia Co., or any of the leading machine makers, he will get all the information he desires, and get better ideas from their illustrations than can be given in writing."

Draw-Knife.—LONDON STAIR BUILDER writes, in reply to W. W. M. (*Glasgow*) (see page 830, Vol. II.):—"You should write to Melhuish, tool dealer, Fetter Lane, London, E.C. I think they could supply you with the draw-knife and chamfer gauge. I fancy the latter is a Yankee invention, and costs 60 cents in the United States of America."

Plate Rack Rods.—J. B. F. (*Eastbourne*) writes:—"*Re* your answer to J. N. (*Erith*) (see page 812, Vol. II.), what he wants is supplied by the Cheap Wood Co., 72, Bishopsgate Street Within, E.C., under 'Sash-Bars and Rounds,' No. 289, and costs 2s. 1d. per 100 feet."

Impressions.—DUBLINIENSIS writes, in reply to H. M. (*Leeds*) (see page 781, Vol. II.):—"Some years ago I wanted to do a similar job, to send the impression abroad for purpose of recognition by a supposed owner of the book. I managed it very fairly thus (I must first say the impression was in *intaglio*):—I placed the book in a box, the edges of which were about an inch higher than the book, first covering the gilt edges with brown paper, lapping the edges inside the covers; then I got some nice tissue-paper, and damped it on both sides with hot olive oil with a flat camel-hair brush, laid it evenly on cover, and covering this with hot very fine silver sand to about ½ in. thick, smoothed it, and then laid over that an even-surfaced board, which was weighted down with two half-hundred weights, and let it remain a couple of days, when I removed all, and found I had an excellent cameo impression."

Band-Saw Machine.—TEAK writes, in reply to J. H. (*Sheffield*) (see page 765, Vol. II.):—"He will find suitable machine by sending 6½d. for catalogue (of six hundred engravings) to M. Tiersot, 16, Rue des Gravilliers, Paris."

Castings.—PARTICK writes (see page 782, Vol. II.):—"If J. D. (*Glasgow*) will communicate with . Munro, 1, Ewing Place, Partick, he will get the desired information."

Screen to Fold Both Ways.—W. S. (*Rugby*) writes, in reply to F. C. (*Swanley*) (see page 780, Vol. II.):—"Perhaps this may suit you. The edges of side-rails are rounded, and must be 4 in. longer than sereen—2 in. at top and 2 in. at bottom. These ends are reduced to form a nice dowel, the use of which will be presently seen. Now take a round rod same thickness as frame, and the same length, on opposite sides; make a nice hollow all its length, so that the rounded edges of frame will fit in nicely. You now want four round pieces each 2 in. long, and same thickness, with a hole bored right through to fit nicely on the dowels of frame. Fix two of these at bottom of centre rod in the hollows, one on each side; take the leaves of your screen, and drop the dowels into the holes; now take the other pieces with holes in them, and drop them over dowels at top; glue, and fix in hollows; and there you are with a hinge that will fold both ways, and show no opening. I may say that it is not necessary to have the sides of frame round, provided the edges are made so, and a piece of bamboo will do well for the tubes."

Window-Cleaning Chemicals.—H. B. S. writes, in reply to C. T. (*Ashton-under-Lyne*) (see page 634, Vol. II.):—"The composition of window-cleaning liquid is dilute hydrofluoric acid. The cleaner mixes a little of the strong acid with water in a pail, rubs it on the windows, and quickly washes it off again; if left on the windows, it quickly etches them—*i.e.*, renders them dull and opaque. It cannot be kept in a glass bottle, as it dissolves glass, but is sold in gutta-percha bottles. It must be carefully used, as it causes very bad sores if spilt on the hands; it rapidly clears away grease and dirt from factory windows, and that is what it is used for. I believe there is a Window Cleaning Co. in Leeds who hold a patent for the use of it for that purpose, but I may be mistaken."

Rods for Plate Rack.—F. S. (*Highbury*) writes, in reply to J. N. (*Erith*) (see page 812, Vol. II.):—"Rods from ½ in. up to 1½ in. may be bought at any timber yard that stock Swedish mouldings. Stuarts', Drayton Park, Holloway, supply them at 2s. 6d. per 100 feet, ½ in. thick."

Violin Book and Tools.—J. H. W. (*Leeds*) writes, in reply to J. E. (*Chatham*) (see page 814, Vol. II.):—"I can, as the result of practical experience, recommend 'The Violin as it was and is,' published by Ward & Lock. With regard to tools, I shall in a few weeks be in a position to supply the same at a reasonable rate, and shall then advertise them in WORK."

Window Steaming.—J. (*Portsmouth*) writes, in reply to the inquiry by J. B. (*Colchester*) (see page 670, Vol. II.):—"Nothing will cure this like ventilation, and I would suggest J. B.'s carrying a flue, if possible, directly from over gas jets, as in the improved sun-burners, into a chimney flue—not directly outside, as in this latter case it is almost certain to produce an in-draught. There is generally a spare chimney flue over most shops, the precaution being first taken that there is an up-draught in the chimney. If this does not quite cure it, a few holes in addition may be cut in bottom of window, and covered with fine gauze to keep out dust, thus forming a current of *cool* air across inside of glass. Will H. Hinge allow me to thank him for his very clear description of Ottoman couch? so plain, that I think the most of us amateurs can understand it. My better-half intends me to have a good try at it, as soon as I have time to spare. Can he suggest any style of hinge, to enable it to be opened from either side? A strong pin firmly screwed on to each corner, and dropping into a metal V bearing, or something of that sort."

Rods for Plate Rack.—F. H. (*Streatham*) writes, in reply to J. N. (*Erith*) (see page 812, Vol. II.):—"Joseph Sandell & Co., 101, Waterloo Bridge Road, or any moulding merchant will supply J. N. with ⅜ in., ½ in., ⅝ in., and ¾ in. round moulding for plate racks. They are made in lengths from 6 feet to 20 feet. J. N. will find, by getting the rods from a moulding merchant, that he will save himself a lot of trouble."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. C. P. (*Lambeth*); T. S. (*Kendal*); G. S.; L. K.; ENGRAVER; W. S. (*Cambridge*); H. W. (*Rochester*); E. C. (*Bristol*); W. G. (*London, W.*); W. F. M. (*Paddington, W.*); ELECTRICAL; G. G. (*Abergavenny*); W. H. B. (*Birmingham*); J. O.; INQUIRER; L. S. L. (*Kirkcaldy*); ALADDIN; S. D. (*Wigan*); W. J. T. (*Aston*); H. L. (*London*); PERCY; B. F. E. (*Carlisle*); J. M. (*Midhurst*); AMATEUR; DEWDROP; ST. CRISPIN; T. R. (*Belford*); T. J. (*Handsworth*); C. S. (*Nottingham*); W. H.; J. H. (*Manchester*); OLD CLOCK; H. P. (*London, W.*); DARKEY; T. H. (*Staffs.*); J. B. (*Derby*); AUCKLAND; BARRA; LENSES; F. H. (*Newington*); J. A. (*Gristhorpe*); BERTIE; W. W. (*Eastbourne*); E. M. J. (*Wrexham*); B. A. B. (*Hampstead, N.W.*); J. S. (*London, N.*); R. J. S. (*Wolverhampton*); LOTO; W. H. C. (*London, N.E.*); W. T. H. (*Somerset*); CHEMICUS; E. A. and W. G. (*Bristol*); R. C. M. (*Bristol*); A. L. (*London, S.E.*); A PLUMBER; F. S. (*Kidderminster*); M. A. H. (*Richmond*); J. M. (*Sunderland*); A. N. F. C. (*Christchurch*); R. W. (*Radnor*); F. A. (*Portsmouth*); TOPPER; SILICATO; J. K. (*Birmingham*); CARPENTER; J. T. (*London, S.W.*); E. L. M. (*Finsbury, E.C.*); W. R. S. (*Nottingham*); E. R. D.; PAINTER; A CONSTANT READER OF "WORK"; V. S. (*Kensington*); A. D. (*Newcastle-on-Tyne*); A READER FROM NO. 1 OF "WORK"; G. J. R. (*Walthamstow*); SNOB; L. A. (*Hampstead, N.W.*); A SUBSCRIBER; JOBBER; J. Z. (*Somerset*); PEN AND INK; SNIP.

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